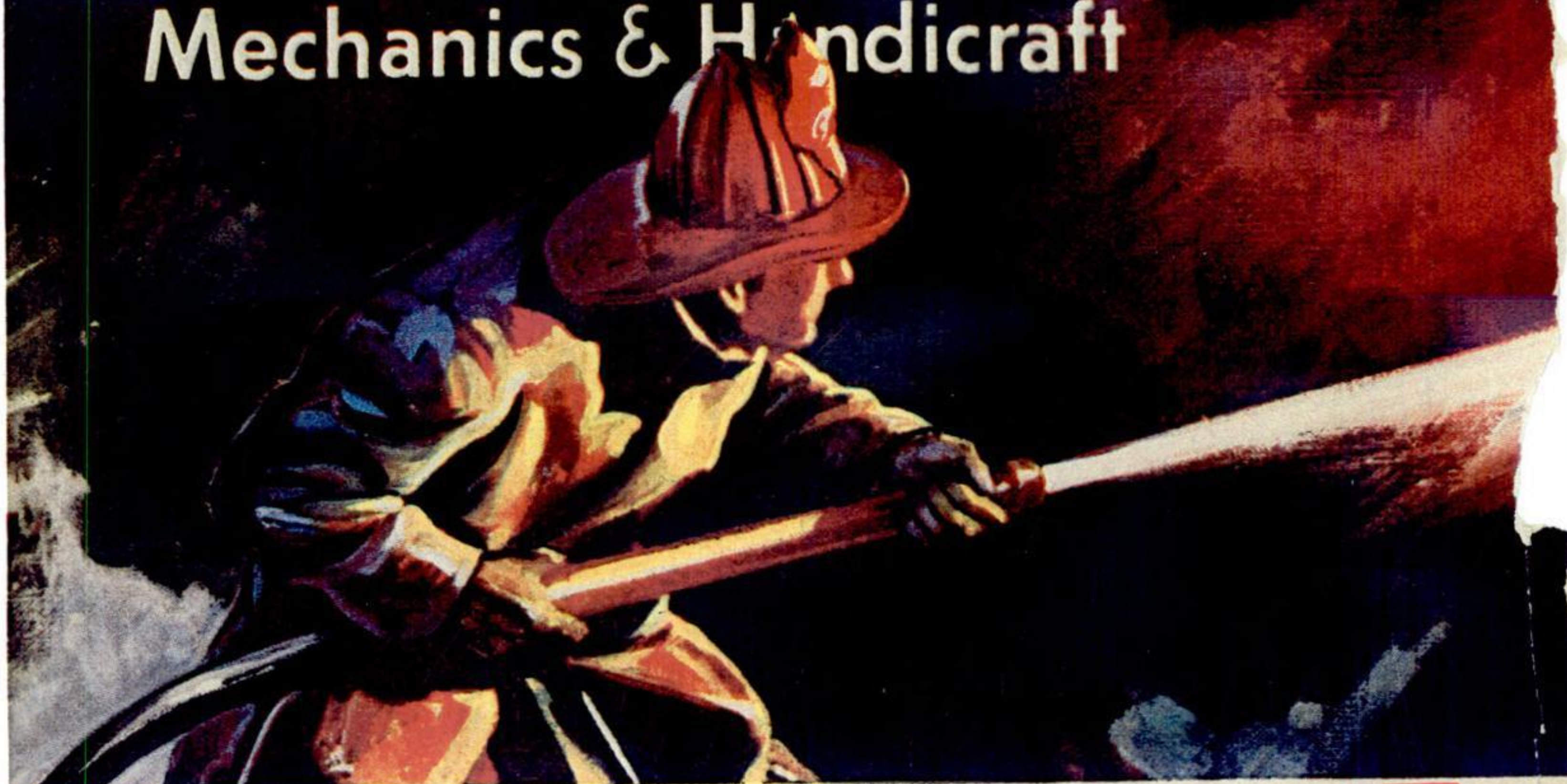


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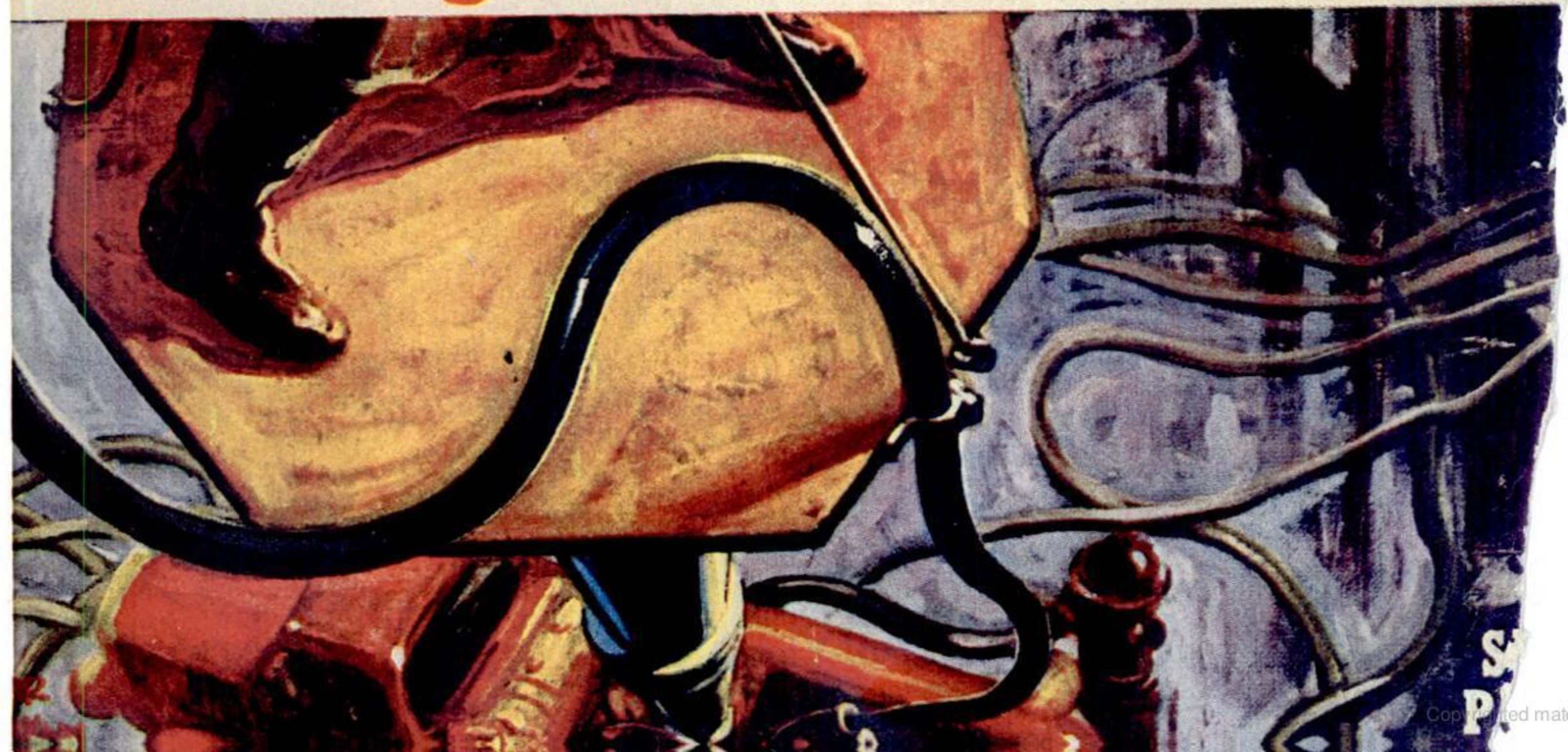
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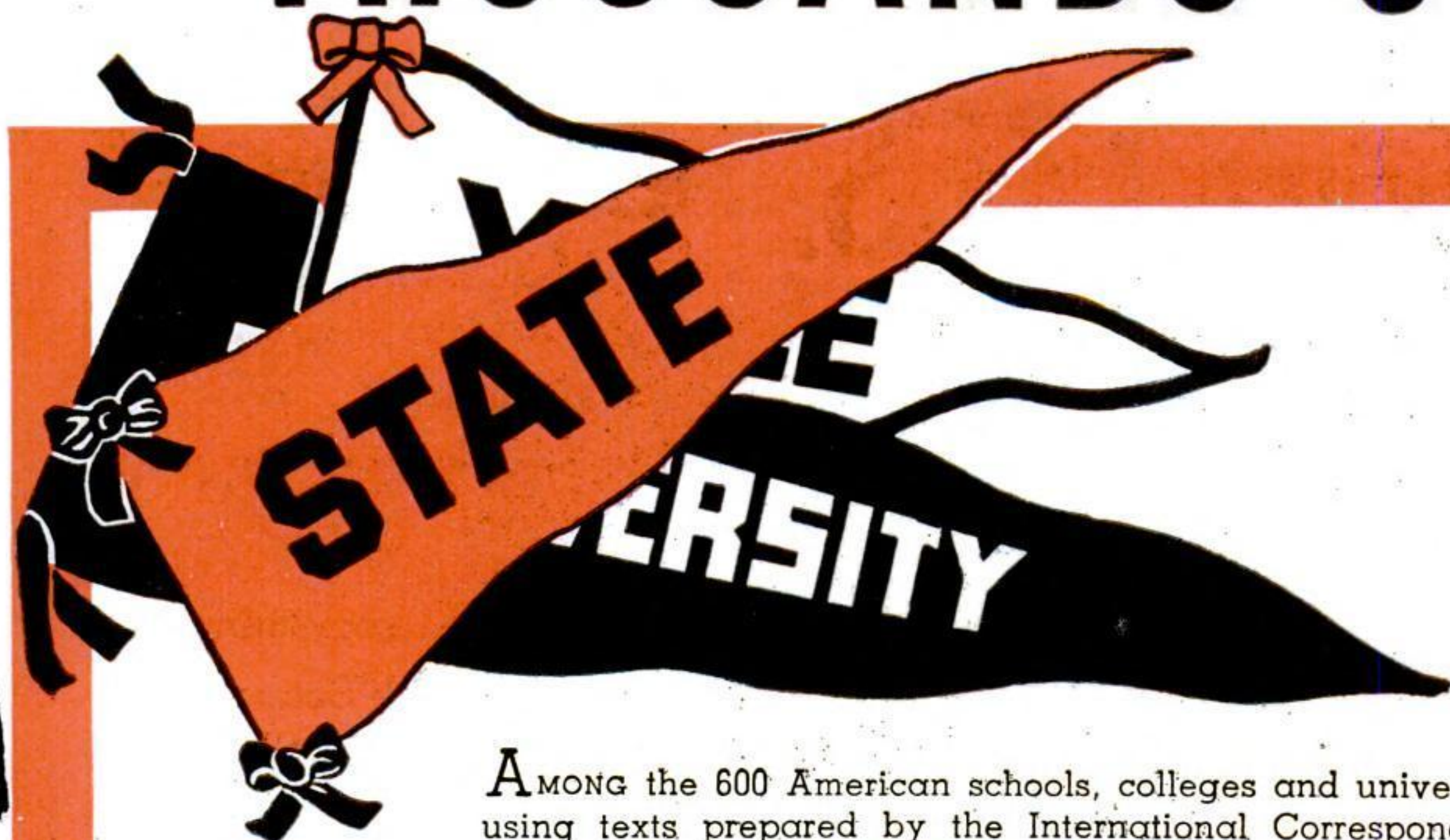
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Founded 1872

MONTHLY
Mechanics & Handicraft

Volume 135, No. 1

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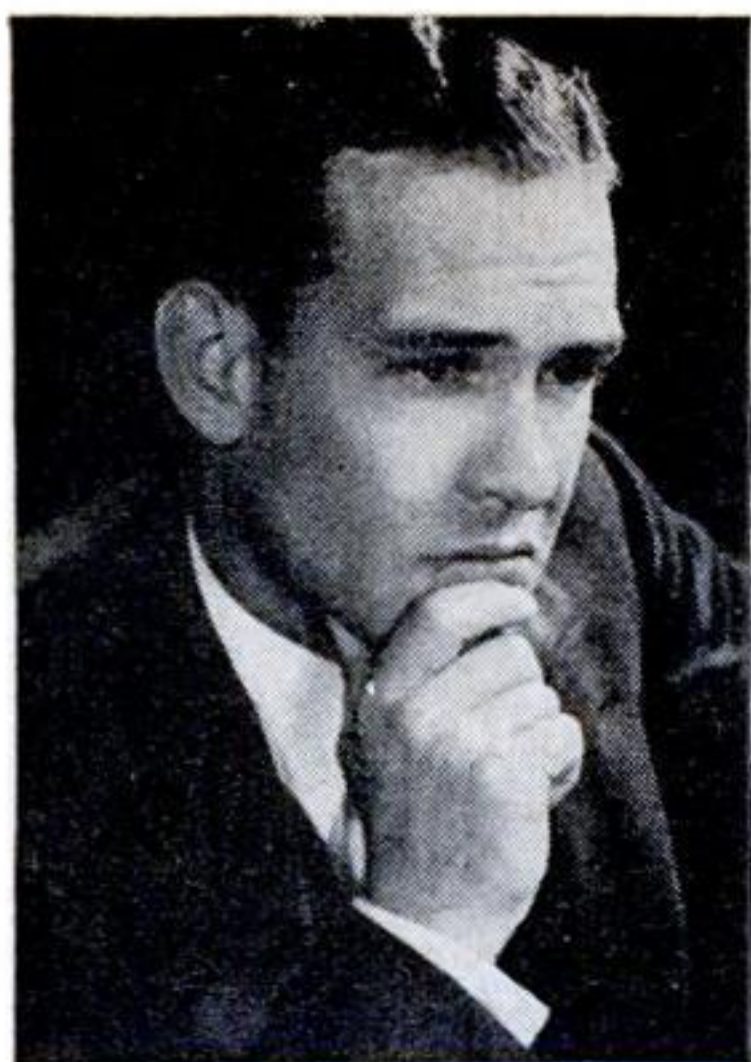
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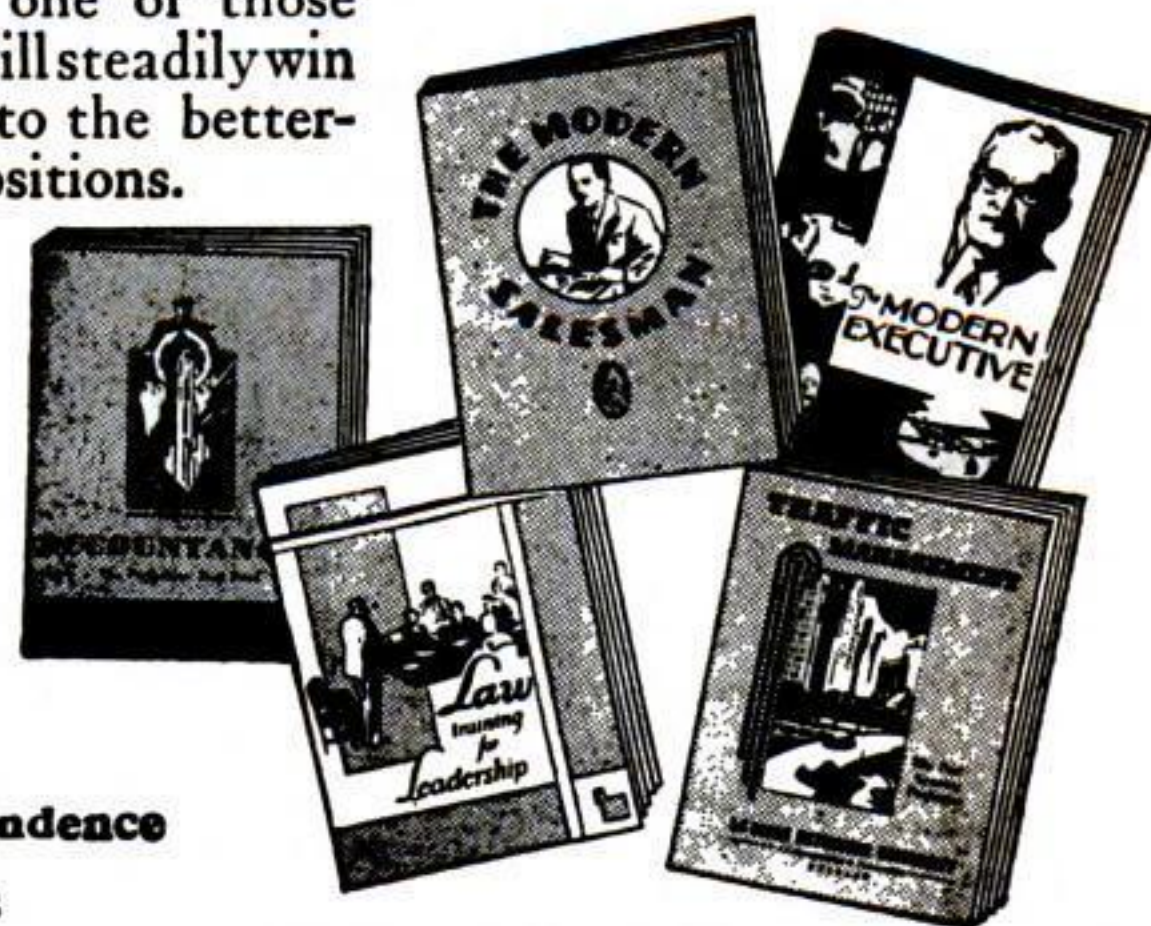
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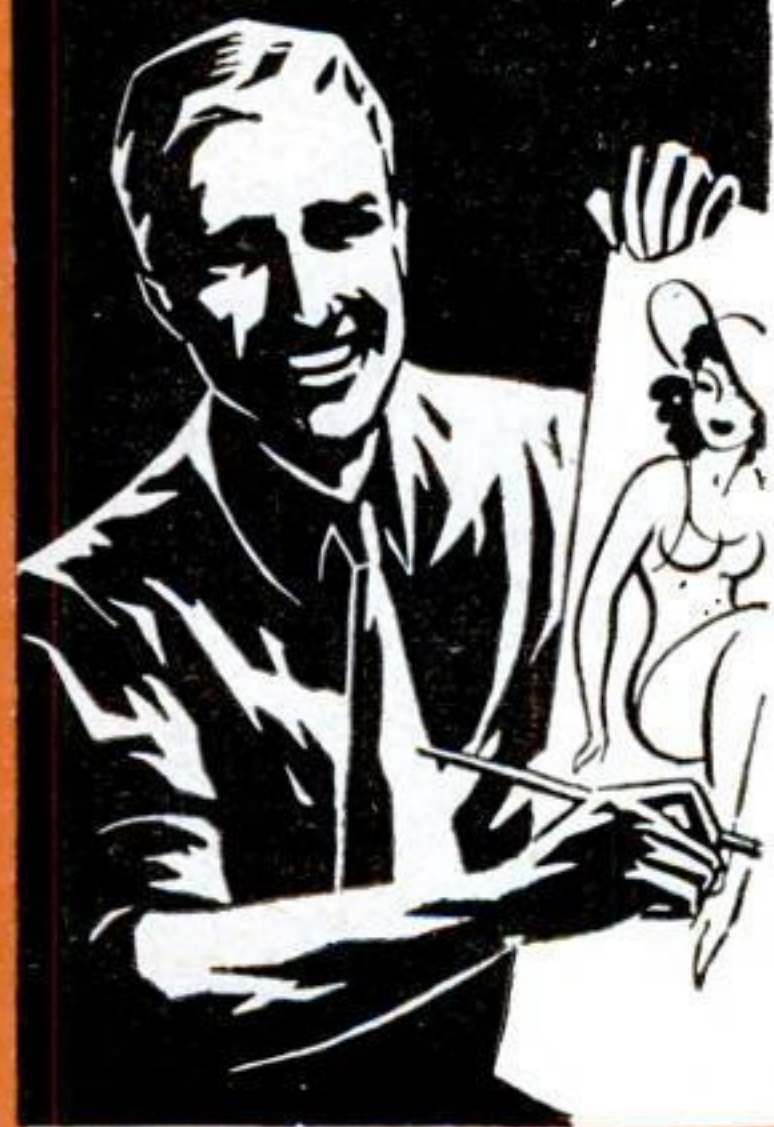
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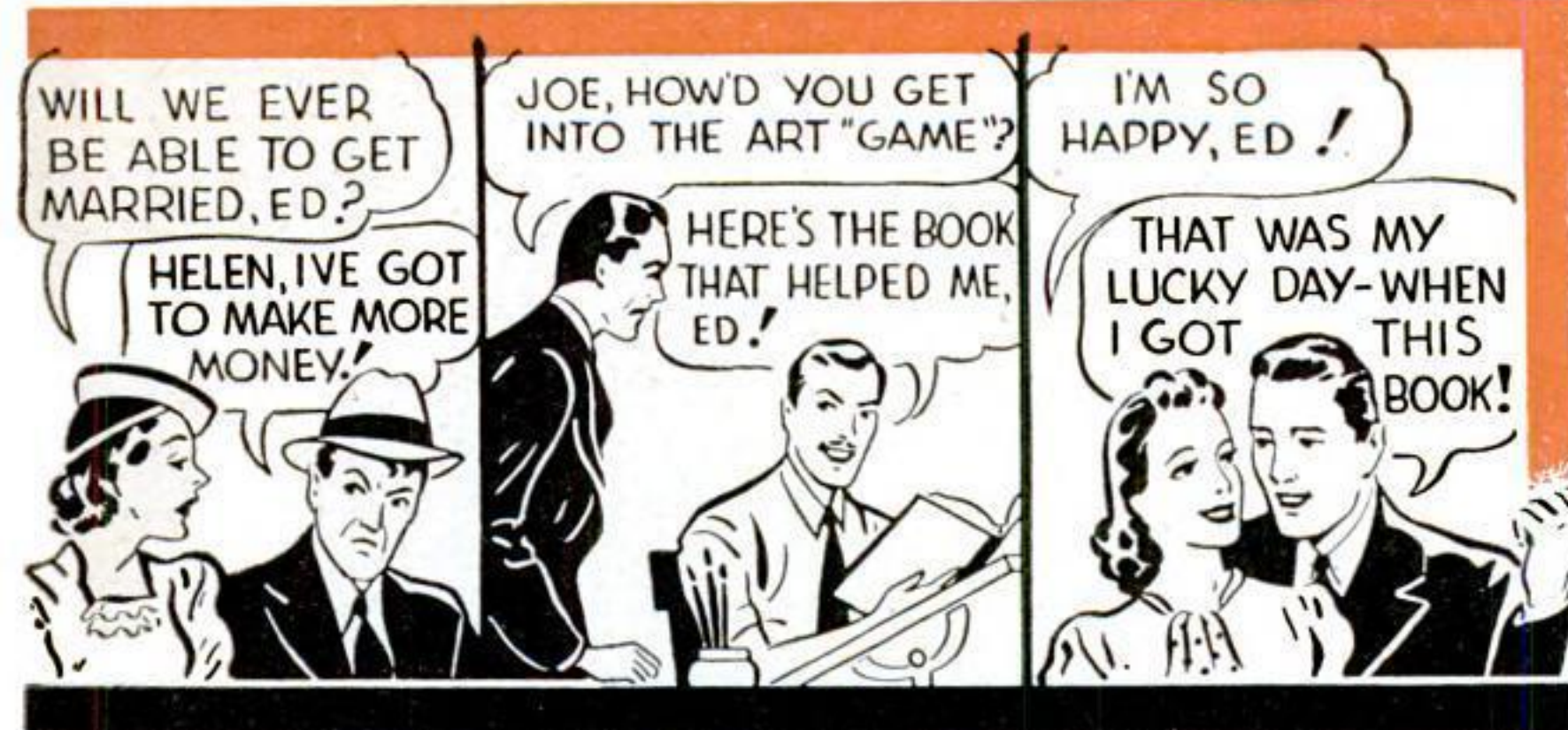
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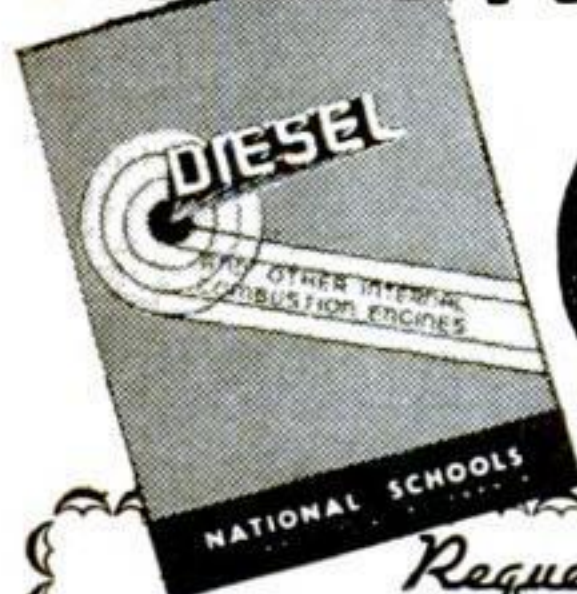
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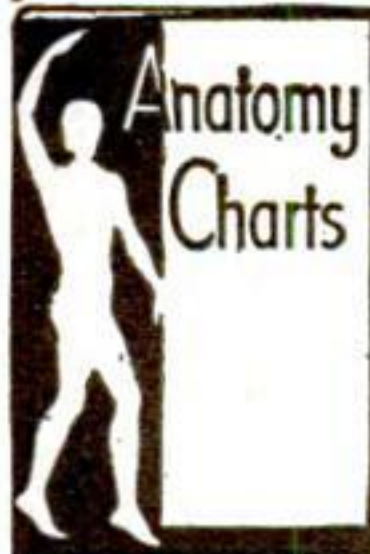
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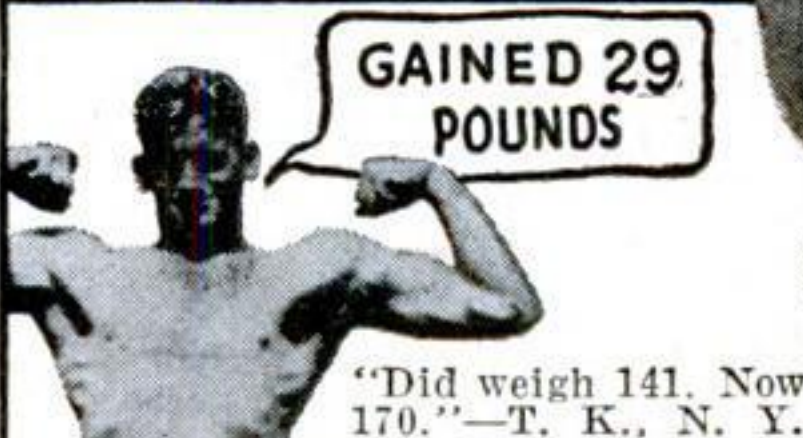
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Our Readers Say



"... Without Any Butter!" He's Got Something There!

WHY not a department in your magazine in which readers could give vent to a little spleen? It does us all good once in a while to give voice to some pet peeve. For example, you could have space in the back of each issue in which each month some reader could express himself thus: "I nominate as my selection of the world's most useless thing to eat—a lettuce-and-tomato sandwich."—A. T., Terre Haute, Ind.



For a Summer Resort, the Sky's the Limit

IN READING a book about the weather, I came across a statement that seven miles above the earth, the temperature is always about fifty-five degrees below zero. When I'm sweltering at my desk this summer, I'll think about that nice, cool place—just seven miles away!—P. A. N., Washington, D. C.

There's a Lot of Evidence To Support the Theory

COULD it be possible that one or more European rulers have discovered the attractions of "caapi," a powerful narcotic drug in which some Peruvian Indians indulge? I quote from the "Field Museum News": "In about two minutes its effect begins to be apparent. The drinker . . . is swept by dizziness. When this stage has passed he announces that he sees charming landscapes, trees laden with fruits, birds of gorgeous plumage, and other beautiful things. Then, suddenly, the vision changes. Unable longer to support himself, he has hallucinations of persons appearing to ridicule him, of tigers, serpents, and supernatural creatures preparing to attack him, and other fearsome things. . . . When the Indian awakes from his trance he must be held down by force to prevent him from seizing his weapons and attacking the first person he encounters. . . ."—P. T. W., Leonia, N. J.

HOW ABOUT SOME OF
THAT PROHIBITION
STUFF?



Explanation: Those Iodine Bottles Are Just Meant To Upset You

ANSWERING T. T. P., Wayne, Mich., in the May issue, you must understand that iodine bottles are made to upset so you will buy more iodine. Not only that, but to ruin your wife's fine tablecloth. Now, all you have to do is clean out one of those well-designed, nontipping ink bottles and pour the iodine into it. Then send the iodine bottle with ten cents to some one, with a letter of not more than ten swear words, and get a late-model whoosis. Hurry!—W. C. W., Youngstown, Ohio.

Who Wants To Take a Picture of an Old Tin Can?

THE other day, I read a newspaper item about the San Francisco, Calif., branch of the Society for the Prevention of Cruelty to Animals giving the boys of that city small cameras in exchange for their air rifles. That's great stuff for the birds and squirrels, but a little tough on the boys. I'm an amateur photographer myself, but I also think it's great fun—and good training, too—to learn to shoot with an air rifle. Why can't they just educate the kids with a little old-fashioned propaganda—let them keep their guns, but teach them to save their shot for popping away at tin cans? Then everybody will be happy—boys, squirrels, and even the S.P.C.A.—R. U., Birmingham, Ala.

WHEE!



How About a Museum for Our Own Wooden Horses?

HAND-BORED wooden water mains, believed to have been laid before 1840, were dug up recently in Brooklyn, N. Y., under the shadow of the aging Brooklyn Bridge. Newspapers reported that the clean, tapered-bore holes indicated that they had been used for water distribution. It makes us think of the seven cities of ancient Troy, that archeologists have exposed, built one on top of the other by successive ages of men. It further makes us wonder if history will not repeat itself in the building of new cities on top of cities in our own land. It seems to me the century-old water pipes prove it is al- (Continued on page 14)

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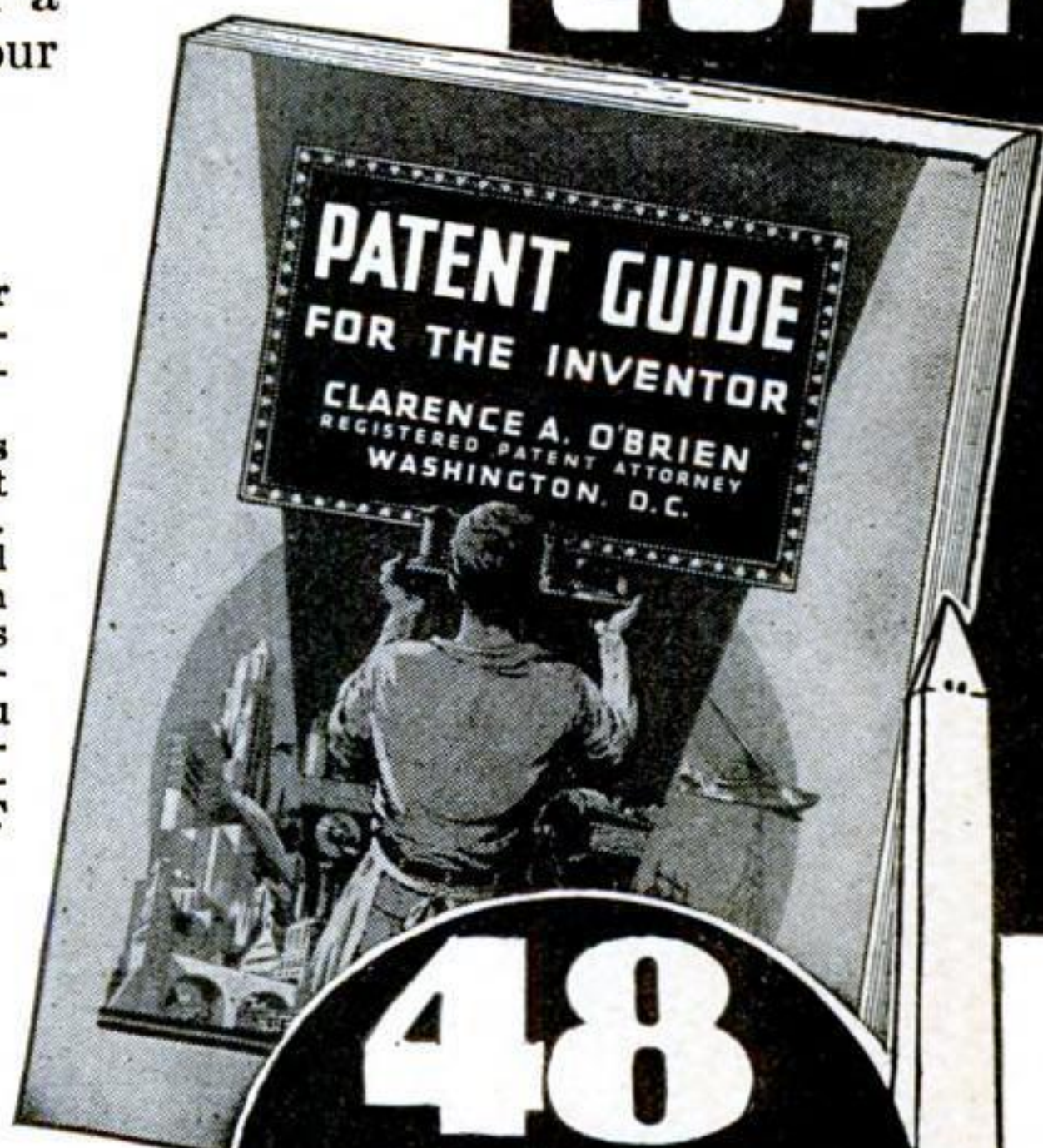
of quick action in applying for patent is stressed—facts revealing danger of delay are emphasized.

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Our Readers Say (CONTINUED)

ready happening. Such relics deserve their own museum.—I. N., New York City.

J. G. May Take a Deep Breath and Turn to Page 49

AS AN old reader of your magazine, may I make a suggestion? Why don't you give us



some articles, or an article, on camping, or on making our own equipment for hikes and camps? I think this would encourage some of your workshop enthusiasts, who may spend too much time indoors, to get out of doors and breathe the fresh air. Here's hoping that my suggestion won't die in the wastebasket, for I am sure

many other readers would be glad to see an article along the lines suggested.—J. G., Mexico City, Mexico.

Three Witnesses Notwithstanding, This Letter Was Dated April 1st

HERE'S another rat story. I think it goes the one in your April issue one better. One day, my grandfather's old black cat caught a mouse at a hole under a sink and, playing rough, she accidentally killed it. The cat looked at the dead mouse a while and then went out, caught another one alive, brought it in, and put it in the hole where she'd killed the first. Three people saw this.—S. W. D., Grampian, Pa.

Too Bad This "Refinery" Can't Turn Out Gasoline

GUS WILSON'S experience with "Varnish"—a New Engine Trouble," was very interesting. I run a gas station, and am sure I have had two customers who got into the same trouble, although not from my service. Both had used

THEY LOOK ALIKE. MAYBE HE USED VARNISH!



cheap oil, as Gus's customer presumably had. We know that such oil usually has not been fully refined to remove all the by-products, sludge, wax, and so on. We also know from experience that when a hot motor is idled, the engine temperature rises, since the radiator is not getting the forced flow of air. Consequently, the increased

temperature acts as a refiner on the flowing oil, somewhat as it does in the big refineries. The by-products are extracted from the oil, leaving the entire motor covered with a film.

Perhaps my version is not practical, but I believe it a possibility.—C. W. H., Rome, N. Y.

He Wants To Survey All He Is Monarch of

DURING the many years that I have been a reader of your excellent magazine, you have published articles telling how to do almost everything under the sun, from deep-sea diving to raising polar bears in your own back yard. However, there is one fascinating activity that I do not remember seeing covered—surveying. Why not give us an article, or a series of articles, describing the fundamentals of this venerable art? You might even tell how to make some simple instruments with which readers could map their farms, city lots, and neighborhoods. It'd be a lot of fun.—H. D. T., Los Angeles, Calif.

AND THEN HE'D SURVEY MY HAT TO SEE IF IT WAS ON STRAIGHT!



His Neighbors Said Something Stronger than Zowie!

LOOKING through my old issues of P.S.M., I came across an article which showed how to construct an inexpensive Tesla coil. I gave it a try. After monkeying around for a week with the thing, I thought it wasn't going to work, but I accidentally touched a live wire and—Zowie! I'll say it worked! The only trouble with it now is that every time I turn it on, the neighborhood radios sound like an air raid in the movies. So, please devise a Tesla coil that won't get me in Dutch.—F. M. W., Cleveland, Ohio.

THAT LIVE WIRE WAS THE MATE TO THIS BRICK!



A Shutter-Tripper's Nightmare Is a Badly Timed Flash Gun

PERHAPS I've just overlooked something in the course of my reading on matters photographic, but I have never run across a simple method of synchronizing my photoflash gun with my camera shutter. When you buy a flash gun, the dealer either does this job for you or assures you the synchronization will be automatic. Sooner or later, the adjustment gets out of whack, however, even though it was right to begin with. This means a trip to the dealer for a servicing job, as a rule. Isn't there some sure-fire, simple way of doing the job yourself, without [\(Continued on page 16\)](#)

Men — If you are mechanically inclined and interested in

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Our Readers Say (CONTINUED)

using up a lot of test film and bulbs? Something that is not just trial-and-error testing, but positive and dependable? If there is, won't you tell us about it?—S. G., Laredo, Tex.

Reader Adds to His "Must" List "News from the World of Medicine"

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ONE of the most readable features in your June issue was the one entitled "News from the World of Medicine," and I'm writing to say I hope it will become a monthly affair. I realize what a task it must be to collect a lot of information on this important branch of science, and then pick out material having both

interest for your readers and information of newsworthy value. If you should decide to run such an article in every issue, it will go on my "must" list for reading, along with "Readers Say," "Gus and Joe," "Question Bee," and the photography items. Nice going!—T. S., Montpelier, Vt.

The Problem Presented No Great Problem to Him

THE problem submitted by G. C., of New Orleans, La., about the club members who wanted to raise money for a statue presented no great difficulties. Here is my solution. Let x represent the number of charter members who pay \$4.50 annual dues each. Let y be the number of dollars dues paid totally each year by all the other members. A couple of simple equations can be drawn up to show that x equals 80.—E. E. McI., Jr., Evanston, Ill.

We Took the Right Boat but the Wrong Railroad

IN THE article, "Low Bridge," in the March issue, reference is made to the Canadian Pacific Railway having been asked by a mining company to transport the 100-foot river steamer *Radium King* from Montreal to the banks of the Mackenzie River, on the other side of the continent. May I point out that it was the Canadian National Railways that transported this steamer?

The first shipment moved in March 1937, requiring one box car and five flat cars. The second shipment moved in April the same year, requiring the same equipment. There

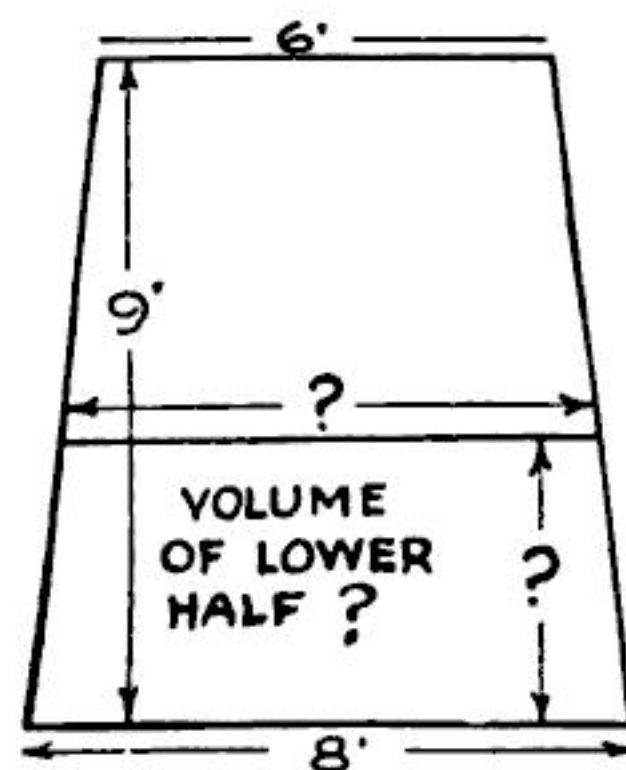
were two boats, *Radium King* and *Radium Queen*. These shipments were made from Sorel, Quebec, on the banks of the St. Lawrence River, forty miles east of Montreal, for through movements on the Canadian National Railways, thence by Alberta Waterways to the banks of the Mackenzie.—A. N. L., Montreal, Canada.

Reversing the Color Lenses Gives the Same Odd Effect

A QUEER thing happened after I inspected the stereoscopic picture on page 65 of the May issue. I followed the instruction and saw the relief picture of a section of Utah, which looked like an aerial view, as you said it would. I then turned the map so the bottom was where the top should be, just to see what it looked like. To my astonishment, the whole effect changed. The hills became valleys and the valleys became mountains. It looked as though the whole area had been turned inside out. Just try it. You'll find it a queer experience.—J. K., Douglas, Ariz.

The Writer Warns You— It's a Tough One

SEVERAL mathematicians I know have given up trying to solve this problem, others are still working on it. The writer has had better success, solving it by two different methods. The problem is to divide a tank shaped like a truncated cone into two halves of equal volume. It is obvious that the lower half will not be as high as the upper half. Find the height, top diameter, and volume of the lower half. The tank's dimensions are as follows: Top diameter, 6 feet; bottom diameter, 8 feet; height, 9 feet.—S. P. G., Los Angeles, Calif.



He'd Have Us Short-Circuit Elementary Radio Article

IN ANSWER to D. da C., who asked in a recent issue for an article on elementary radio building, I would like to suggest that instead of skipping over your good radio articles, he purchase a handbook on radio building, so that he can then understand them as so many of your other readers do. I am hoping you will not print such an article, because, for one thing, I think you have gone practically to the beginning of radio building in previous issues. Incidentally, I'm looking forward to a good article on an amplifier for a carbon-mike, public-address system.—J. B. de M., Vancouver, B. C.

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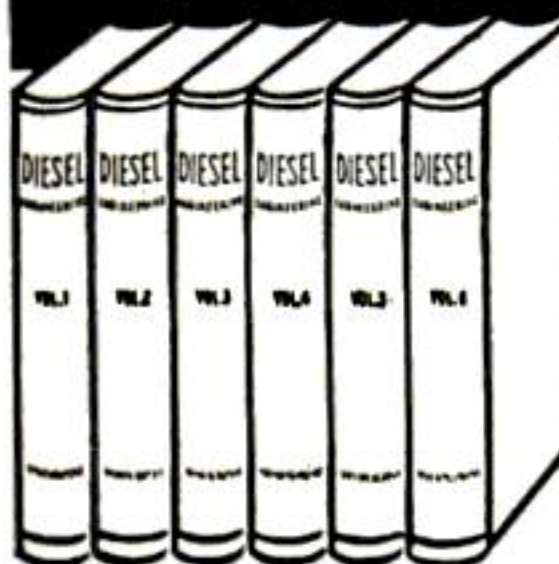
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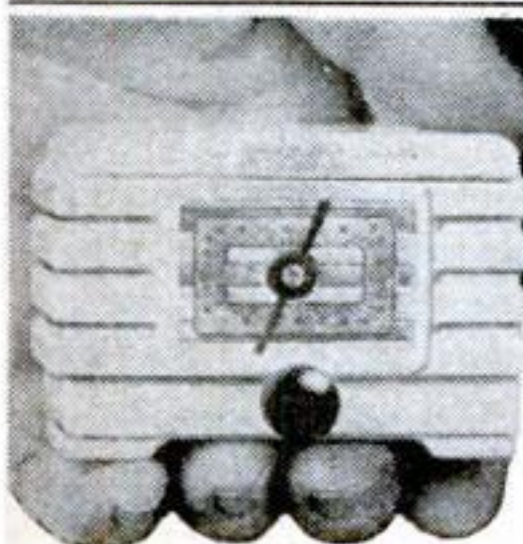
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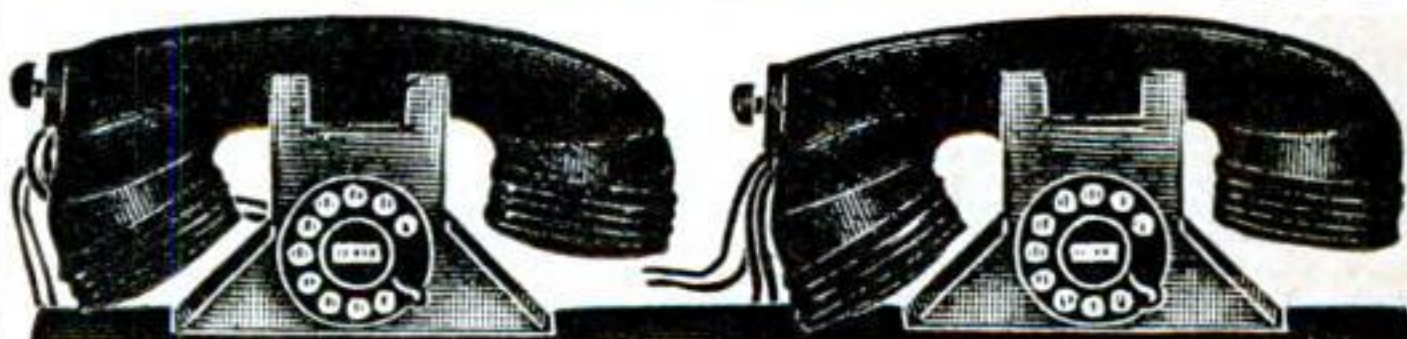
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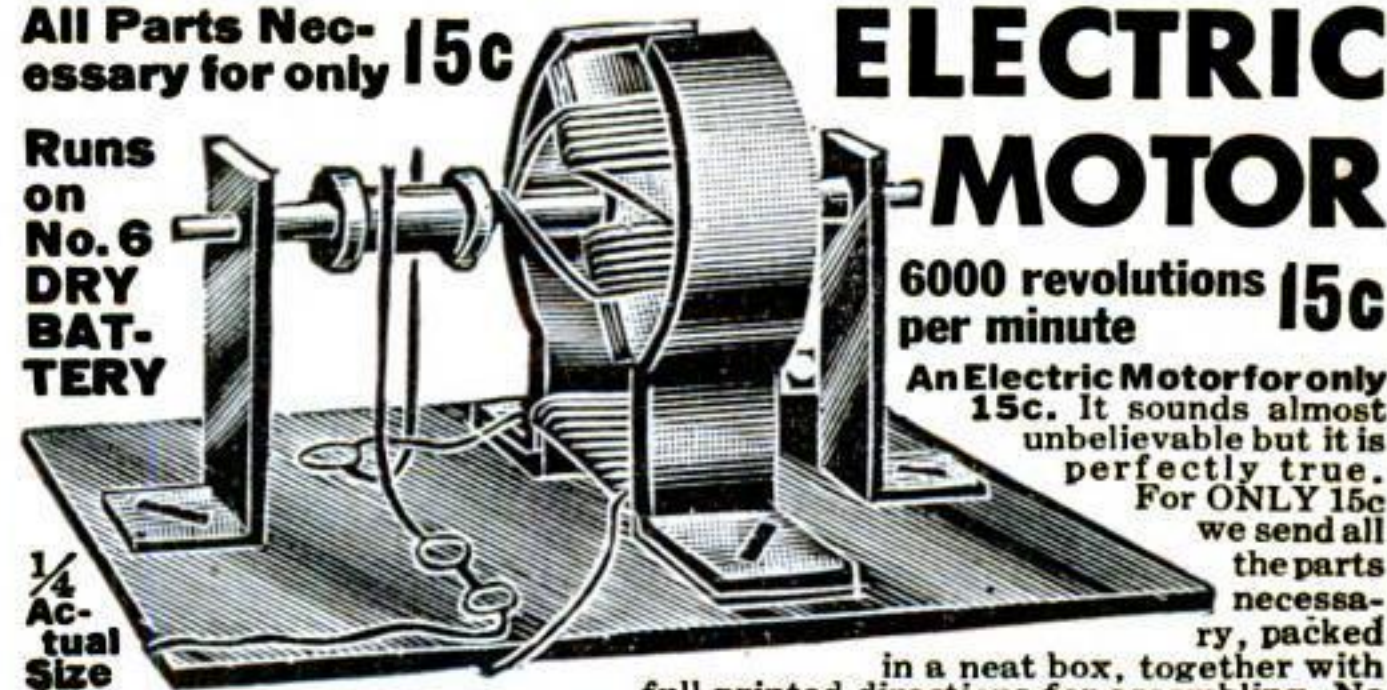
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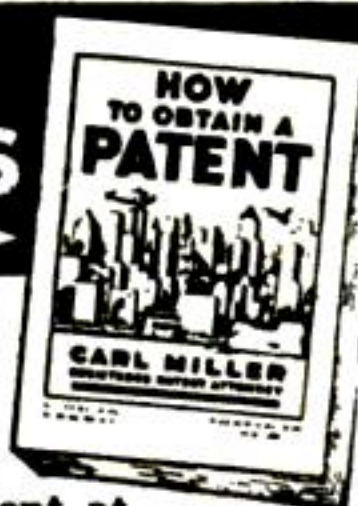
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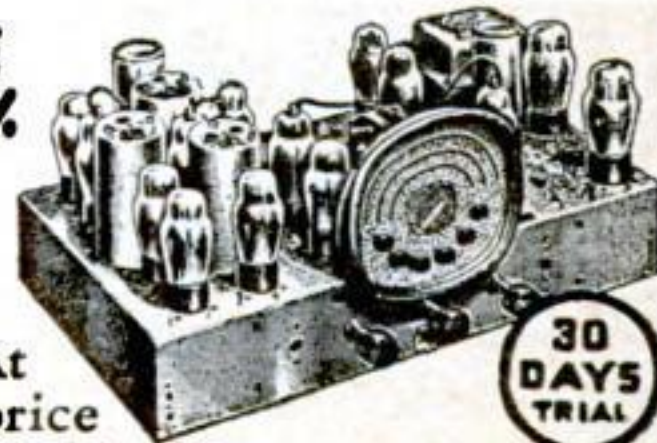
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With the Inventors

MAYBE that old wisecrack about a "fur-lined" bathtub was not so far-fetched after all, for John Monge, Staunton, Ill., inventor, recently won a patent for a rubber bathtub cushion. Extending over the tub rim and running part way down the inside, the



sponge-rubber shock absorber is designed to prevent injury to a person who accidentally slips and falls in or against the bathtub. The elastic action of the cushion makes it cling tightly to the tub rim . . . ONCE A PATENT has been issued, it passes completely out of the jurisdiction of the Patent Office, which is not concerned thereafter with the scope of the patent, its possible infringement, nor

any other question that may arise concerning it . . . MUSIC WILL DROWN OUT the sound of the buzzing drill and take patients' minds off the discomforts of an hour with the dentist, hopes Marion H. Gray, of Little Rock, Ark., who has devised a musical headrest for dental chairs. Radio programs, or musical selections reproduced through a record player, are wired to receivers built into the chair headrest. Operating on the bone-conduction principle, like many of the electrical hearing aids used by the deaf, the headrest receivers will enable a patient to hear diverting entertainment clearly, without disturbing the dentist, as might be the case if a radio or phonograph were playing right in the dental office. A volume control and on-off switch are mounted on the chair arm in a convenient position for the patient . . . AT LEAST TWENTY different persons have claimed to be the original inventor of the Trylon and Perisphere, the architec-



tural theme center of the New York World's Fair . . . "SLOW DOWN, CURVE." That familiar highway sign may become outmoded, if automobile manufacturers adopt a novel control system devised by Allison R. Williams, of Yazoo City, Miss. Electrically connected to



the braking system of a car, a sensitive balance reacting to centrifugal force automatically slows the vehicle down if it is rounding a curve at a speed in excess of a predetermined safety rate. Thus if a reckless driver tries to make a sharp turn at fifty miles an hour, the mechanism will apply the brakes to slow the car down to a reasonable speed . . . CRYPTIC PATENT TITLE of the month:

"Foots-Removing Means For Expressing Presses." Decoded, the title could be expressed as: A means for removing sediment or dregs (foots) in a machine press designed for squeezing liquid from a material . . . AN INGENIOUS OUTBOARD-MOTOR attachment worked out by William Newton, of Omaha, Nebr., keeps minnows and other small fishing bait alive by providing them with a constant supply of fresh water. Flexible hoses leading from a bait pail in the fishing boat are attached to the water-cooling system of the outboard motor, so that fresh water is drawn from a lake or



stream and circulated through the bait pail. With this attachment, anglers will not have to stop their boat periodically to dip up fresh water for the bait pail, and will not arrive at their fishing grounds with bait dead or dying from the effects of hot sun and stagnant water . . . APPLICATIONS PENDING in the

(Continued on page 24)

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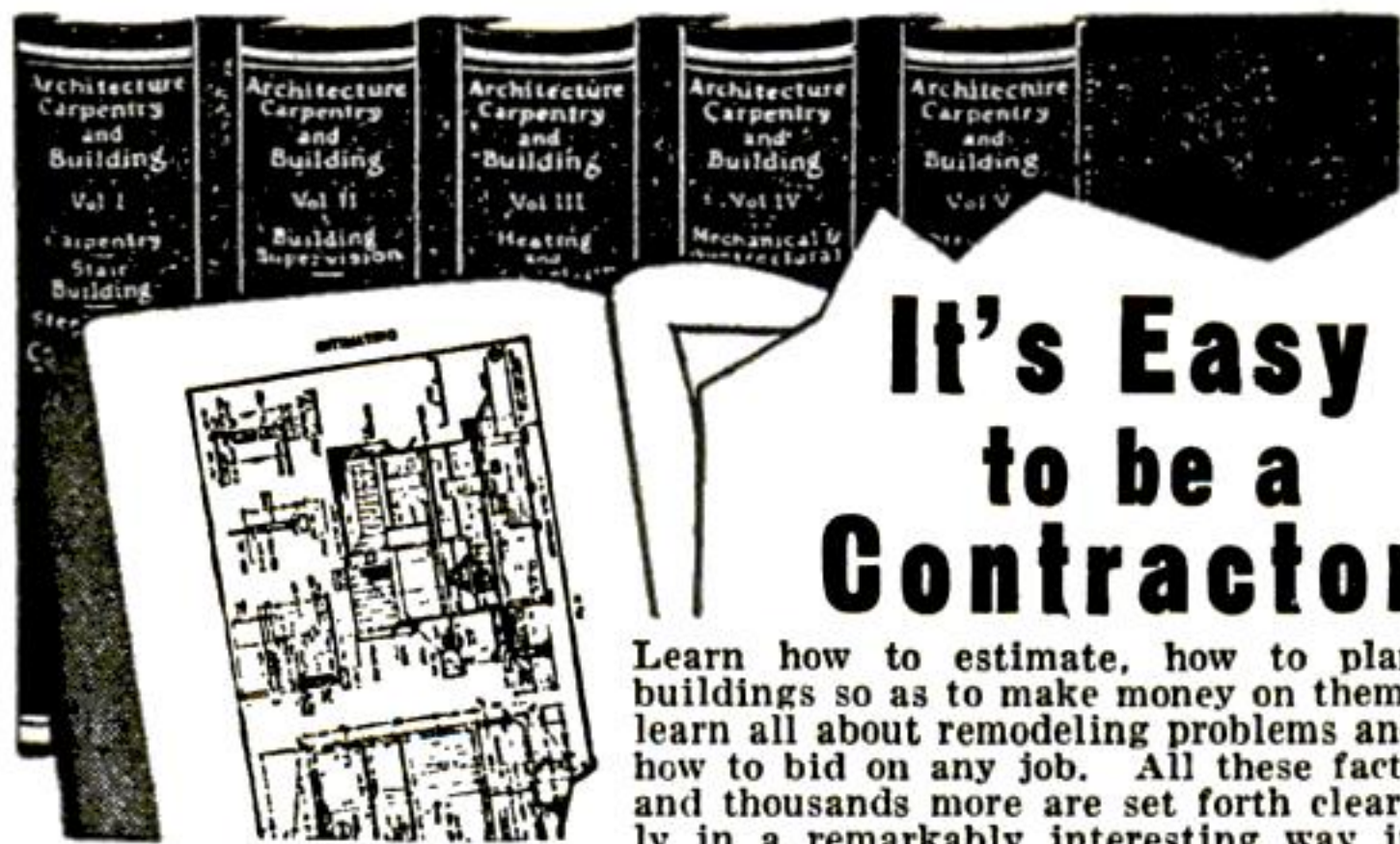
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With the Inventors

(Continued from page 22)

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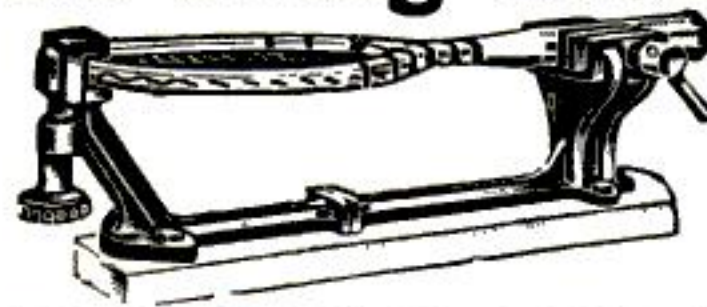
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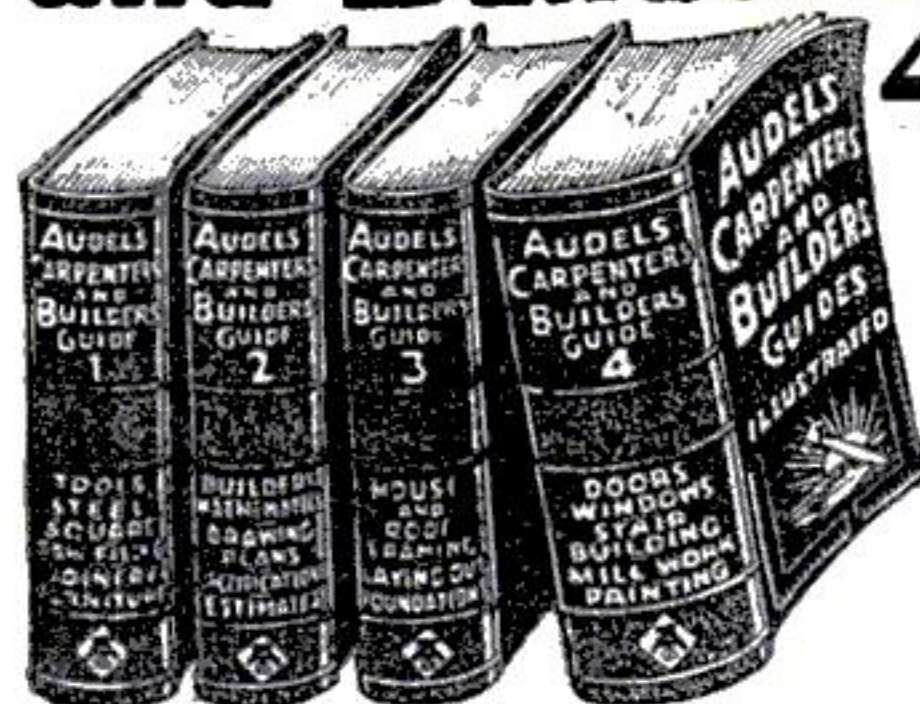
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WOULD GIVE A COOKIE
TO BE HERE!

CHUBBINS, YOUR
GREAT-GREAT-GREAT-GRANDFATHER
FOUGHT HERE SIDE BY SIDE WITH
COL. ETHAN ALLEN IN
REVOLUTIONARY DAYS

I'LL BET THOSE
OLD CANNONS
GOT PLENTY HOT
IN THE THICK
OF BATTLE

WHAT DIDN'T
A LITTLE REVOLUTIONARY
AS YOU KNOW,
THEY EVEN SMOKED
PIPE MADE OF LEAD

HM-M, A HOT SMOKE
ISN'T NECESSARILY THE
PIPE'S FAULT. TOBACCO
IN THOSE DAYS DIDN'T
SMOKE TOO COOL!

HUMPH! I KNOW
WHERE THERE'S
AN OLD LEAD PIPE,
JUDGE. LET'S TRY
SOME OF YOUR
TOBACCO IN IT JUST
FOR THE FUN OF IT

OKAY—I'M ALL
READY!

HA! HA! JUDGE,
YOU WIN—WE BOTH
KNOW PRINCE ALBERT
WOULD SMOKE COOL
IN ANY PIPE!

REMEMBER, CHUBBINS,
WHEN WE WERE CROSSING
THE MISSISSIPPI? THAT
MAN BET ME MY BRAND
WOULDN'T SMOKE COOL
IN A CORN-COB

YES! AND HE
WASN'T SORRY
TO LOSE THAT
WAGER—HA/HA!
HE BORROWED
HALF YOUR
TIN OF P.A.

PRINCE ALBERT HAS OPENED
MANY A PIPE-SMOKER'S
EYES TO HOW MELLOW
YET RICH-FLAVORED
A TOBACCO CAN BE

YES, P.A.'S
JUST RIGHT—
THERE'S NO
OTHER TOBACCO
LIKE IT!

ETHAN ALLEN DOORS

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Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage.

(Signed) R. J. Reynolds Tobacco Company,
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P. A. IS MILDER, TASTIER IN
YOUR "MAKIN'S" SMOKES TOO

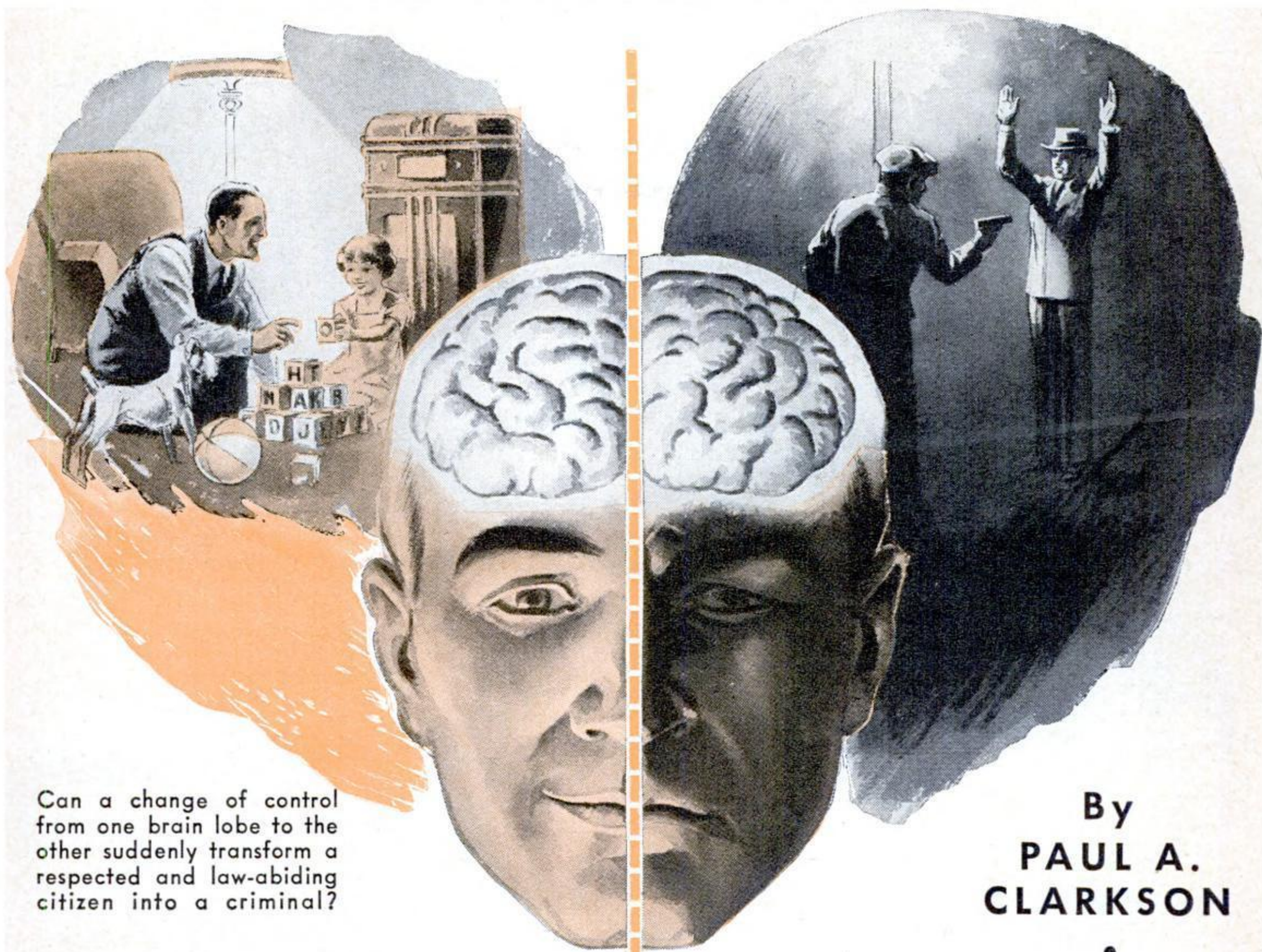
PRINCE ALBERT IS SO
EASY ON THE TONGUE
BECAUSE IT'S
NO-BITE
TREATED—AND IT'S
CRIMP CUT TO DRAW RIGHT



50

pipefuls of fra-
grant tobacco in
every pocket tin
of Prince Albert

PRINCE ALBERT THE NATIONAL
JOY SMOKE



Can a change of control from one brain lobe to the other suddenly transform a respected and law-abiding citizen into a criminal?

By
**PAUL A.
CLARKSON**

CAN new discoveries about the brain reclaim a million criminals? Can psychological research cut America's crime bill in half? Can scientists, using drugs and surgery, eliminate dishonest impulses from the minds of crooks?

Questions like these may sound fantastic. Yet developments of recent weeks bring them to the fore. One of the most famous psychiatrists in the world, Dr. Carleton Simon, of New York City, has just announced a revolutionary new theory which may help science control criminal tendencies.

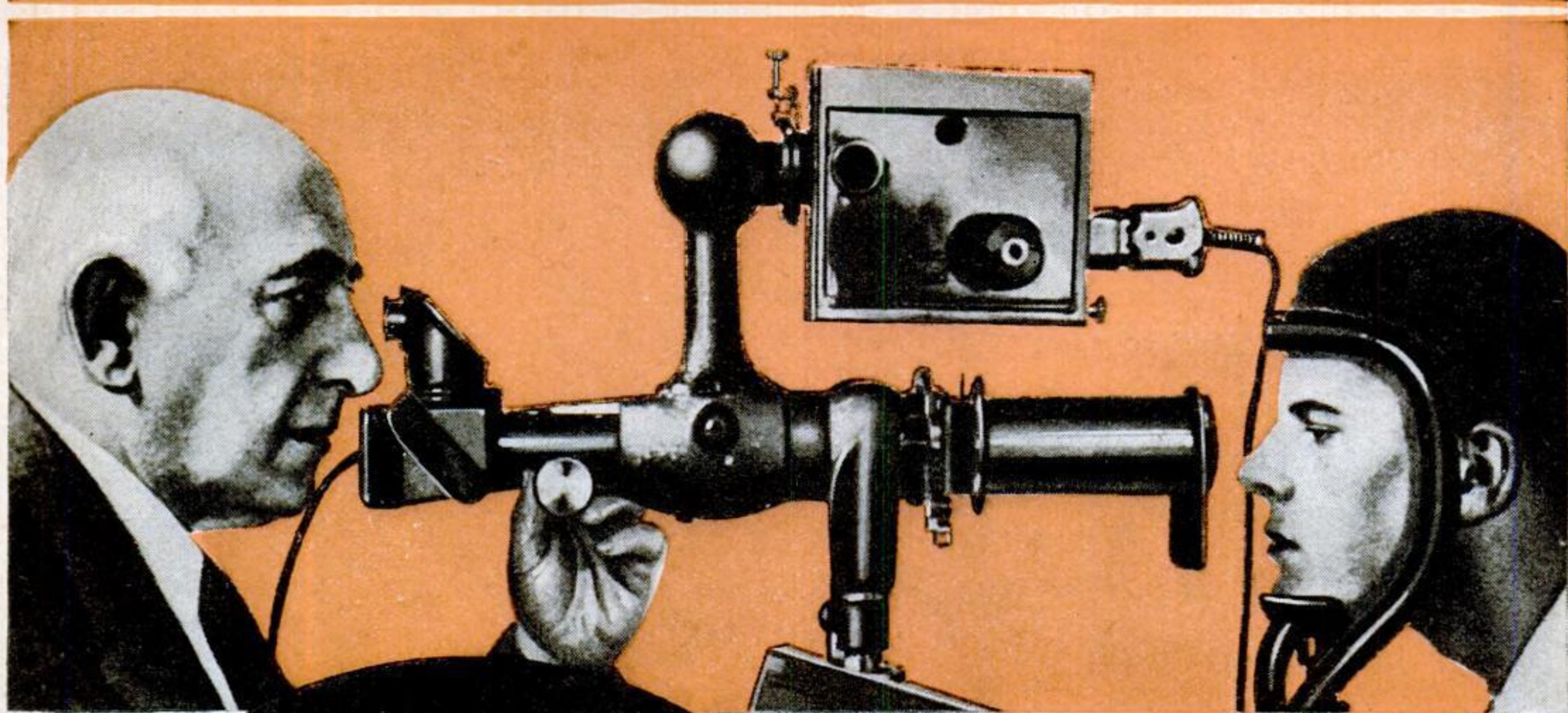
All of us have two arms, two legs, two eyes, two ears, two lungs, two lobes to our brains. Almost always, Dr. Simon points out, one of the pair is stronger than the other. One

Have You a Wrong Way Brain ?

eye, for example, is keener than the other; one ear is more sensitive. Similarly, Dr. Simon suggests, one lobe of the brain is stronger and dominates the other lobe. It dictates our reaction to situations and may be said to represent the normal character of the individual.

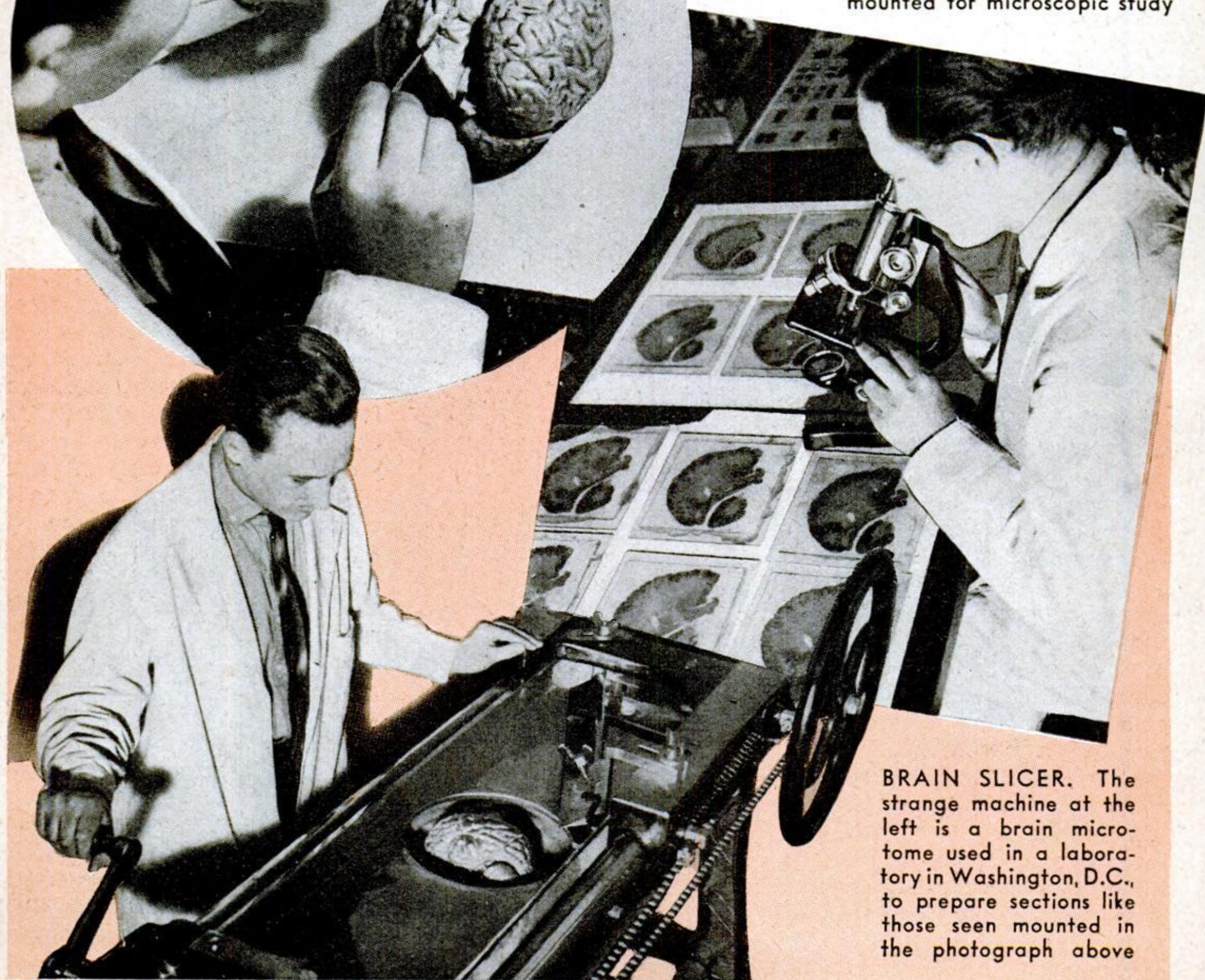
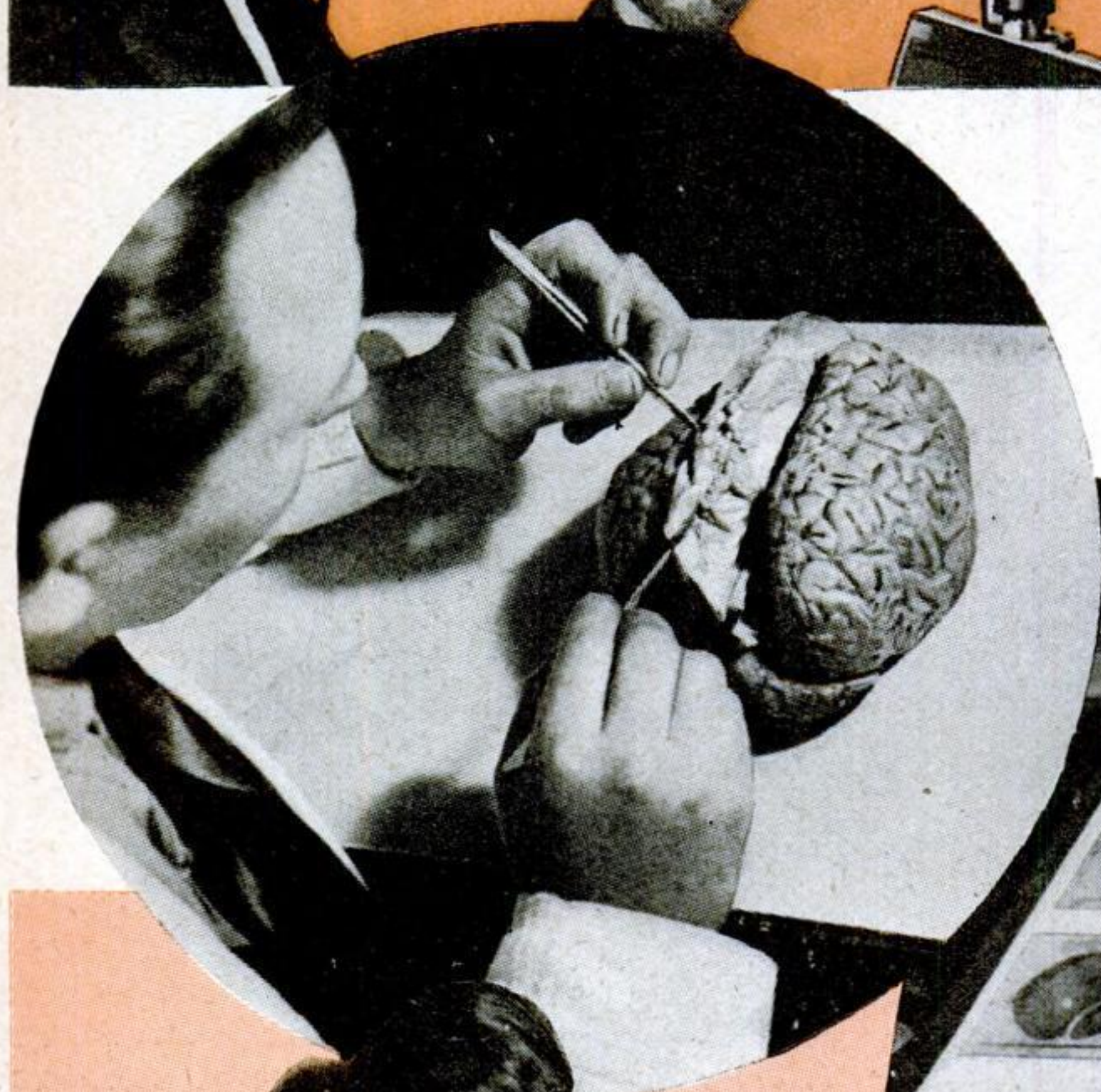
Occasionally, however, the weaker lobe gains the mastery. For the time being, the nature of the individual changes. Dr. Jekyll becomes Mr. Hyde; the law-abiding citizen becomes a criminal.

In New York City, the other day, a young musician dropped in to call on a friend at his office. He found the room empty and, on the spur of the moment, picked up a typewriter and carried it to a pawn shop. The next day, conscience-stricken, he returned to con-



DR. CARLETON SIMON, author of the new theory to explain dual personality. He is demonstrating another of his discoveries—the method of photographing veins in the eyes as a means of identification of criminals

Left, dissecting a human brain. Below, serial slices of a brain mounted for microscopic study



BRAIN SLICER. The strange machine at the left is a brain microtome used in a laboratory in Washington, D.C., to prepare sections like those seen mounted in the photograph above

man in New Jersey started out for a rabbit hunt. A few hours later, his companion's shotgun went off accidentally and one of the lead pellets struck the young hunter just above the right eye. Local doctors decided against removing the shot and the patient apparently recovered. But his character began to change. He became shiftless, sullen, and evasive. Money began to disappear from the homes of friends he visited. Finally, late one night, he was caught in the act of breaking into a neighbor's house. When brain experts examined him, they found that the lead had lodged near the brain and was affecting the delicate tissues of one of the lobes. When the pellet was removed, the boy's character returned to normal. Today, he holds a responsible position in his home town.

What proportion of the hundreds of thousands of criminals now in American prisons are suffering from mental ills, no one knows. Experts estimate that as many as eighty-five percent of them are so afflicted. Changing their mental condition is one of the great problems of medical science.

A dramatic example of what surgery may have to contribute in this direction is reported from Washington, D. C. Forty-eight times, Dr. Walter Freeman and Dr. James W. Watts, two skilled brain specialists, have aided mental cases through a daring new technique. Like a housewife inserting a corer in an apple, the surgeons push a narrow, chisel-like sur-

gical instrument into the brain at one temple, moving it carefully upward and downward to sever the frontal areas from the rear "emotion centers." The operation is repeated on the other half of the brain. Results are amazing. Patients who previously were cowering and trembling with insane hallucinations are freed from their fears. The technique is based upon earlier experiments on apes made by the Yale University brain authority, Dr. Carlyle Jacobsen.

Another new treatment for mental ills, of special value in relation to dual personality and crime, is almost as spectacular. It was introduced by a brilliant Viennese physician, Dr. Manfred Sakel. Patients are given "shock doses" of insulin, the gland extract used in treating diabetes. The result is a terrific shock to brain and nerves. Patients often are thrown into convulsions. Yet, in more than 1,000 instances, here and abroad, the violent treatment has justified itself. Men and women suffering from split personality—even those given up as hopelessly insane—have been shocked back to normalcy.

Thus, traveling along different roads, scientists recently have advanced toward better understanding and greater control of mental abnormalities. By cutting the roots of crime in the minds of malefactors, they may some day play a major role in reducing our \$15,000,000,000-a-year crime bill and in turning outlaws into good citizens.

DID COSTER HAVE A DUAL PERSONALITY?

One of the most amazing crime stories of recent years was that of F. Donald Coster, a respected citizen and business man, who was found to have committed a fraud of more than \$18,000,000. Investigation revealed that he had previously been convicted of a similar crime



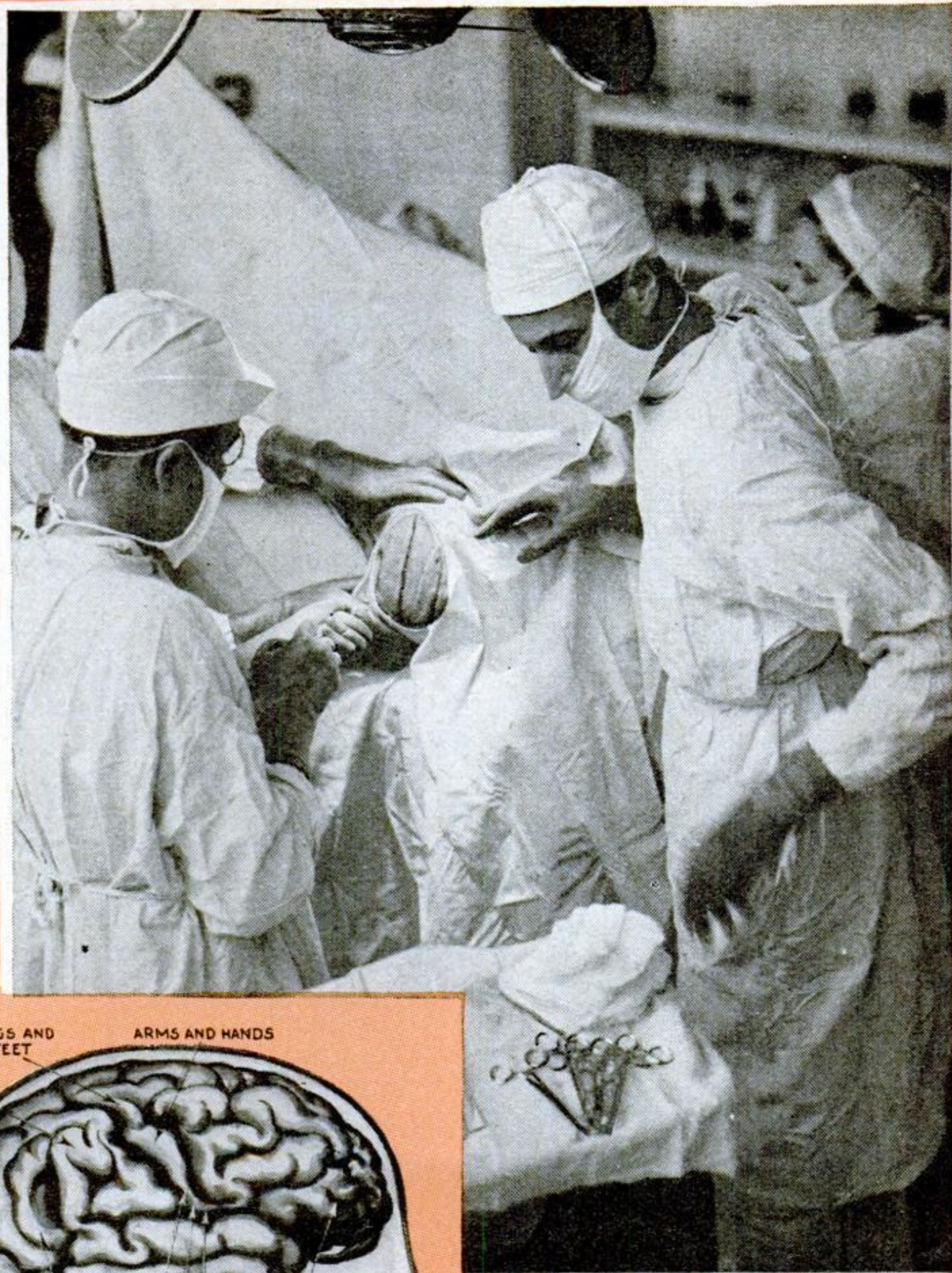


Is he the victim of a wrong-way brain? Scientists think that mental ailments may be to blame for much of our immense crime toll

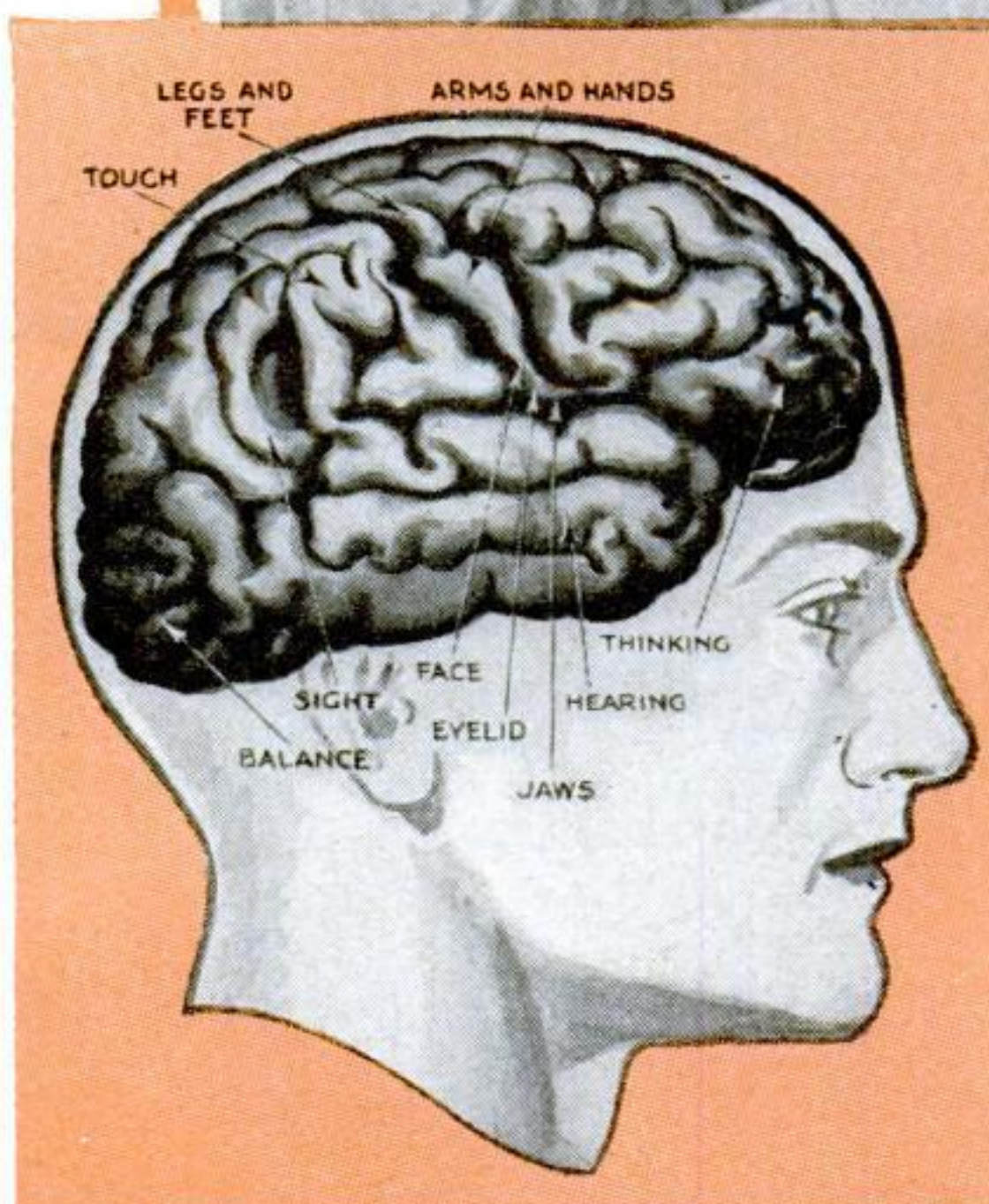
fess what he had done. Again he found his friend had stepped out and, "before he knew what he was doing," he picked up the new typewriter which had been bought to replace the one he had stolen, and pawned it, too. Later, in the police line-up, he declared he couldn't imagine why he had committed the thefts.

According to Dr. Simon's theory, the irrational behavior of the musician was the result of a shift of dominance from the stronger lobe of the brain to the "under-dog" lobe. Normally honest, the musician temporarily became a different person with a criminal outlook. Similarly, wealthy women kleptomaniacs steal articles for which they have no real need, and respected citizens—like Richard Whitney, for years head of the New York Stock Exchange—are convicted of embezzlement.

Such dual personalities form one of the major riddles of criminology. Dr. Simon's simple explanation of what occurs may go far toward helping understand the bewildering behavior of many lawbreakers. At the



Surgeons performing an operation on the brain by cutting away part of the skull. Drawing at left shows brain areas



same time, studies of the brain itself, and recent advances in surgery and the treatment of mental ills, have given science new hope of reclaiming criminals.

At Georgetown University, in Washington, D. C., experts are working in the most elaborate brain laboratory in America. More than 5,000 human and animal brains are available there for study. With amazingly precise mechanisms, the scientists can slice, for examination under the microscope, brain sections less than 1/500 of an inch thick. Out of their researches, they hope to learn more of the physical basis for human conduct.

It has long been known that physical injury to the brain itself frequently alters the character of the victim.

Several years ago, for instance, a young



Come and get it! Healthy outdoor appetites demand plenty of substantial food, wisely selected and well prepared

Camping Tips

FOR SUMMER VACATIONISTS

COOL, pine-scented nights. Crystal lakes teeming with hungry fish. Forest quiet, far from rasping horns, jangling phones, and humdrum daily routine. That's the way you pictured your camping trip before you left home last year.

But you forgot fly dope, and ravenous insects machine-gunned your defenseless skin. Tight shoes rubbed blisters on your aching feet. Rain poured down in oversize buckets—and you hadn't thought to bring along a rubber poncho.

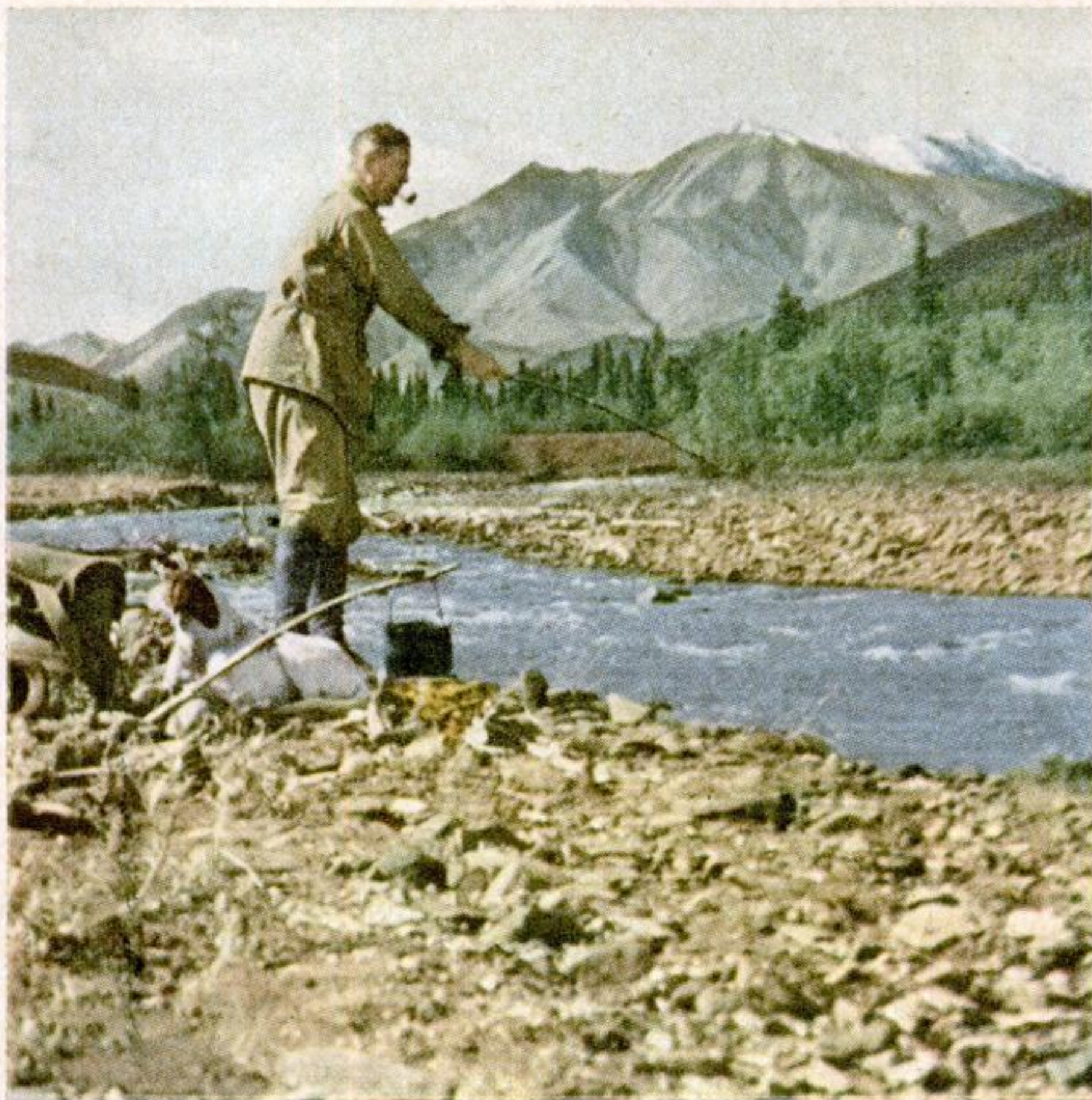
And so you'll never go camping again? Don't you believe it! In anyone who has ever flipped a flapjack over a glowing camp fire, the urge to hit for the woods crops up annually, like a garden weed, despite the best of efforts to stifle it.

But this time, go prepared. Take the old-timers' tip: A camping trip is a success or failure before you ever leave your front doorstep. And planning the details beforehand is not only half the fun, but it's also the best possible insurance for a top-notch wilderness vacation.

Think of a camping trip as setting up housekeeping in the wilds. Check through your home and figure how you'll reproduce all its essentials and many of its conveniences when you're deep in the tall timber. You'll need a roof and walls for shelter. That means a good tent or lean-to. You'll need a kitchen. That means thinking of food, a fire, and cooking utensils.

For a bedroom, you'll require blankets or a sleeping bag, with

By E. W. MURTFELDT



Fish caught right out of a mountain stream help to vary the menu

something comfortable underneath. The bathroom brings up questions of toilet necessities, soap, and a first-aid kit to serve as your open-air medicine cabinet. And your living room is the whole outdoors.

Volumes can be written—and have been—on every detail of living in the open, but you

don't need to spend a week at the library to have a successful trip. It's more fun to figure it out for yourself. Follow the main headings below as a framework, mull over the suggestions given, add a generous helping of plain horse sense, and then go to work preparing for the best vacation you ever had.

FOOD. If you can get to camp by boat or car, the sky's the limit on the food you can take. If you have to tote it for miles, however, choose plain, nourishing food, light in weight. Canned goods are three quarters water, and feel like lead after a ten-mile hike. Bacon, flour, sugar, beans, and coffee are the five essentials. Gelatin supplies quick energy. Allow two pounds of food a day for each camper, and plan the menu of each meal before you leave. Dried fruits, dehydrated vegetables, and powdered milk and coffee weight little and are very palatable in the woods. Nested

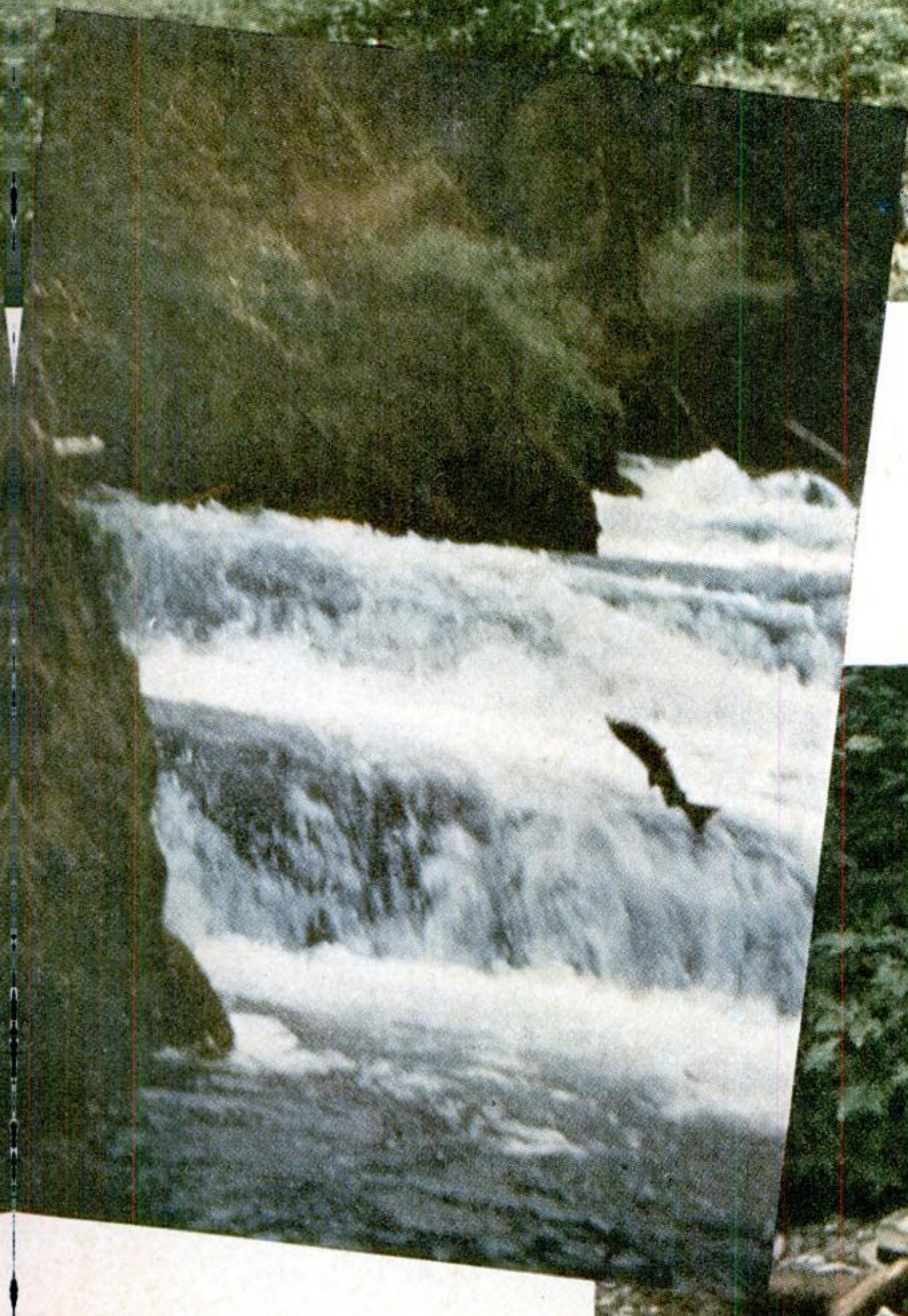
kits of eating utensils save space. For cooking, a skillet, coffeepot, and kettle for boiling and dishwashing are vital.

SHELTER AND CLOTHING. In tents as well as in clothing, remember that light-colored fabrics are more attractive to insects than dark. Balloon cloth is a practical, light-





THE SUCCESS OR FAILURE
OF YOUR OUTING DEPENDS
ON THE WAY YOU PLAN IT



Joys of the outdoors are for those who know how to keep themselves safe, healthy, and comfortable in the wilds. At the right, a pair of tired hikers are giving their feet timely care to avoid blisters



weight tent material. Use a tent having a sewed-in ground cloth, and a mosquito-net flap door. Experienced woodsmen never court insomnia by sleeping on the ground when it isn't absolutely necessary. A folding cot, or an air mattress blown up only part way, makes the best bed. Take two light blankets instead of one heavy one, and remember to put as many blanket thicknesses under you as over you. Wool is best for clothing. Break in those new camp shoes or boots before you leave. Wear silk socks under wool ones when hiking. Soap rubbed around your heel will help prevent blisters.

CAMP FIRE. Don't bother building an architectural masterpiece of stacked wood before starting your fire. Light it first and build it afterwards. Start with tinder, or shavings made with a hunting knife. Light up, then pile on progressively larger wood. Build up a good bed of hot coals for easy cooking. If rocks are scarce, use four empty tin cans to support the corners of a cooking grill. Green limbs and forked sticks will hold pots over the flames without catching fire.

MATCHES. Keep an emergency supply in a waterproof case, preferably one that will float.

WATER. Don't drink water you're not absolutely sure of. Boil it fifteen minutes first.

LIGHT. Take one flash light for every camper. Don't forget that extra batteries

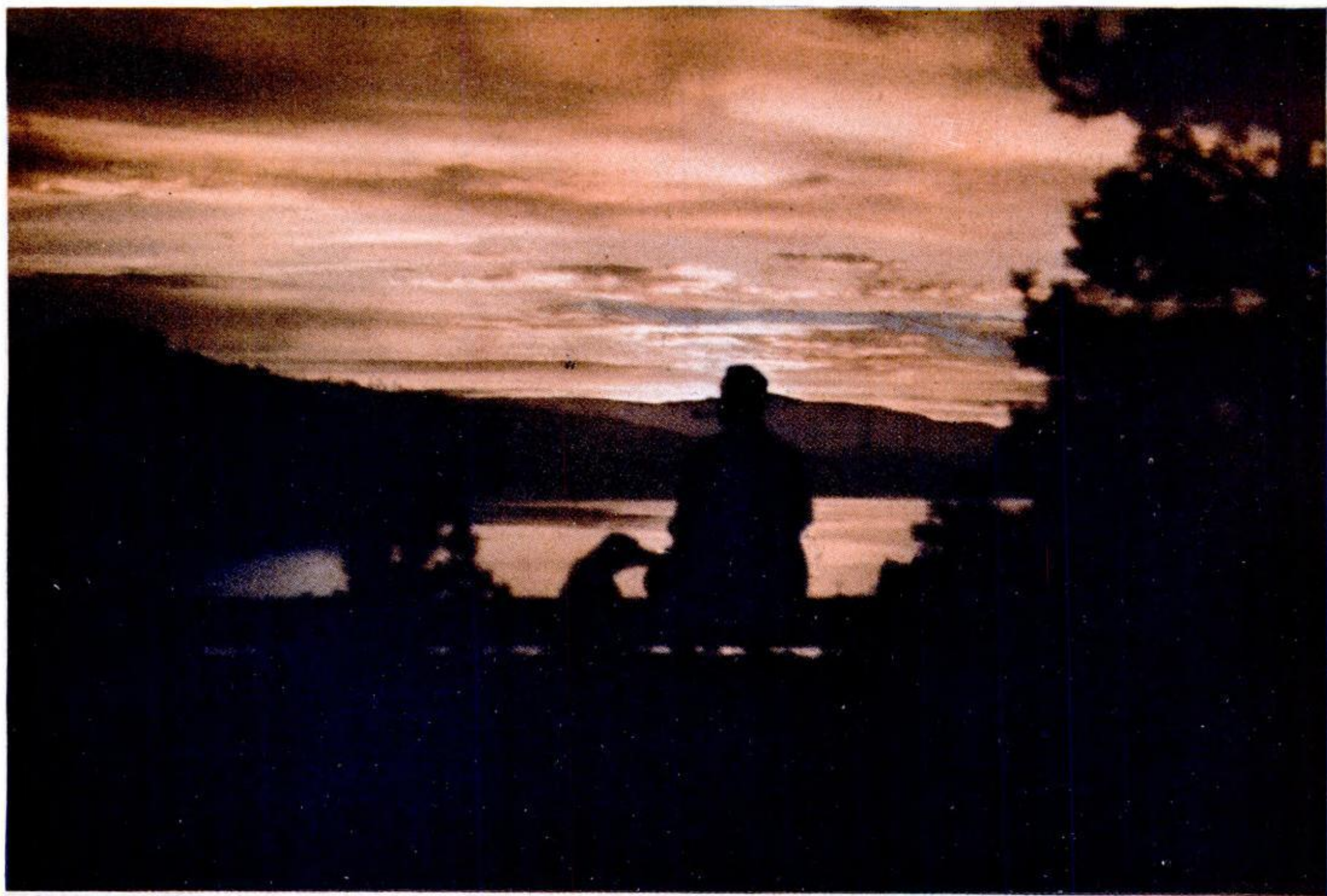
are useless if you have no replacement for a burned-out bulb. A gasoline or electric lantern is handy. So are candles.

GEOGRAPHY. You'll take a compass, but will you wish you had practiced using it *before* you got lost? In a pinch, point the hour hand of your watch at the sun. Half way between the hour hand and twelve on the dial is south. On a hike, turn around and glance back once in a while, to learn how trail landmarks will look when you're hunting for them on the return trip. For good maps at low prices, write the U. S. Geological Survey, Washington, D. C.—in Canada, the Canadian Geological Survey, Ottawa.

FIRST AID. A complete first-aid kit is a "must." But it is designed only for first aid. If you need a doctor, get out of the woods and get one. Amateur doctoring is bad business. Take along a good laxative.

DON'T FORGET. Can opener. Axe. Knife. Adhesive tape. Toilet tissue. Spare shoe laces. Toothbrush. A length of strong cord or wire. Extra glasses, if you wear them.

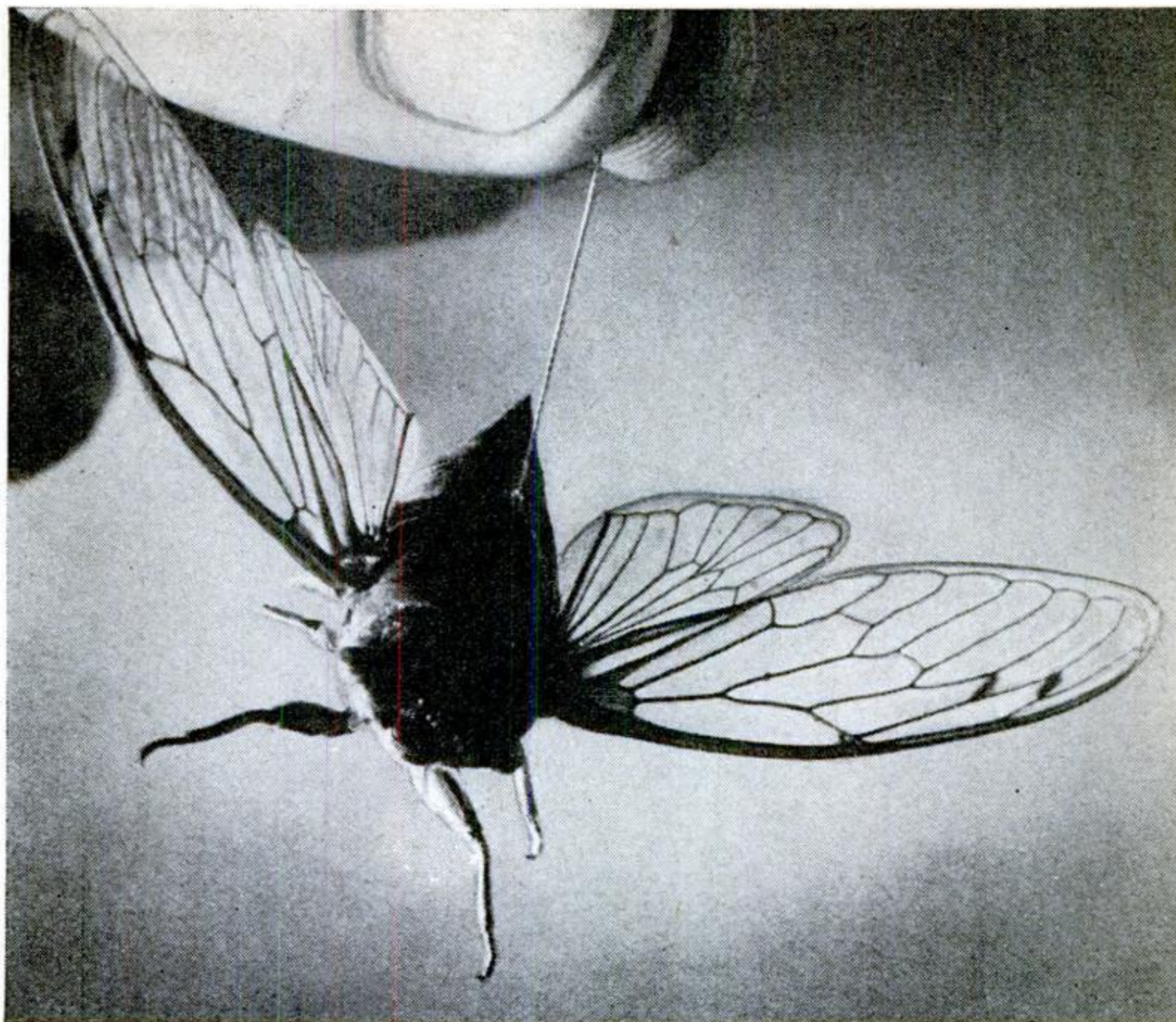
Before you leave, collect and spread out everything you think you might take, and then cast nonessentials aside one by one, paring down to a load you can comfortably transport. Make one final check-up to see that you've forgotten nothing, then hit for the woods. One last thing, though: Did you remember to lock the back door?



The end of a perfect day. Careful planning will make your vacation pay for itself in rest and relaxation

Films Show the Speed of Insect Wings

How rapidly do insects move their wings when in full flight? High-speed motion pictures of flying insects, made by Harvard University and Massachusetts Institute of Technology scientists, prove that the wing-beat rate of some species may be as high as 300 strokes a second. The photograph at the right, taken at an exposure of one hundred-thousandth of a second, shows a captive locust in flight.



This captive locust's wings are beating at a rate of forty-five strokes a second

Toe Gives Jumpers a Lift

NEW high-jumping records may be set by athletes using the special jumping toe shown below, according to its inventor. Screwed to his shoe sole, the duralumin attachment gives the jumper a better footing for his take-off.



Screwed to a shoe sole, metal toe grips the ground



When air is pumped into the unit, the concentration of combustible gas is shown on the dial

Pocket Meter Gauges Gas

CONTRIBUTING to the safety of inspectors and workmen in mines, tunnels, and other underground locations, a battery-operated, pocket-size meter accurately measures the concentration of combustible gases in the atmosphere. A small knob switches the unit on, and a diminutive pump handle is operated to draw in a sample of the air to be tested. Gas concentration is then automatically registered on a dial set into the face of the unit.



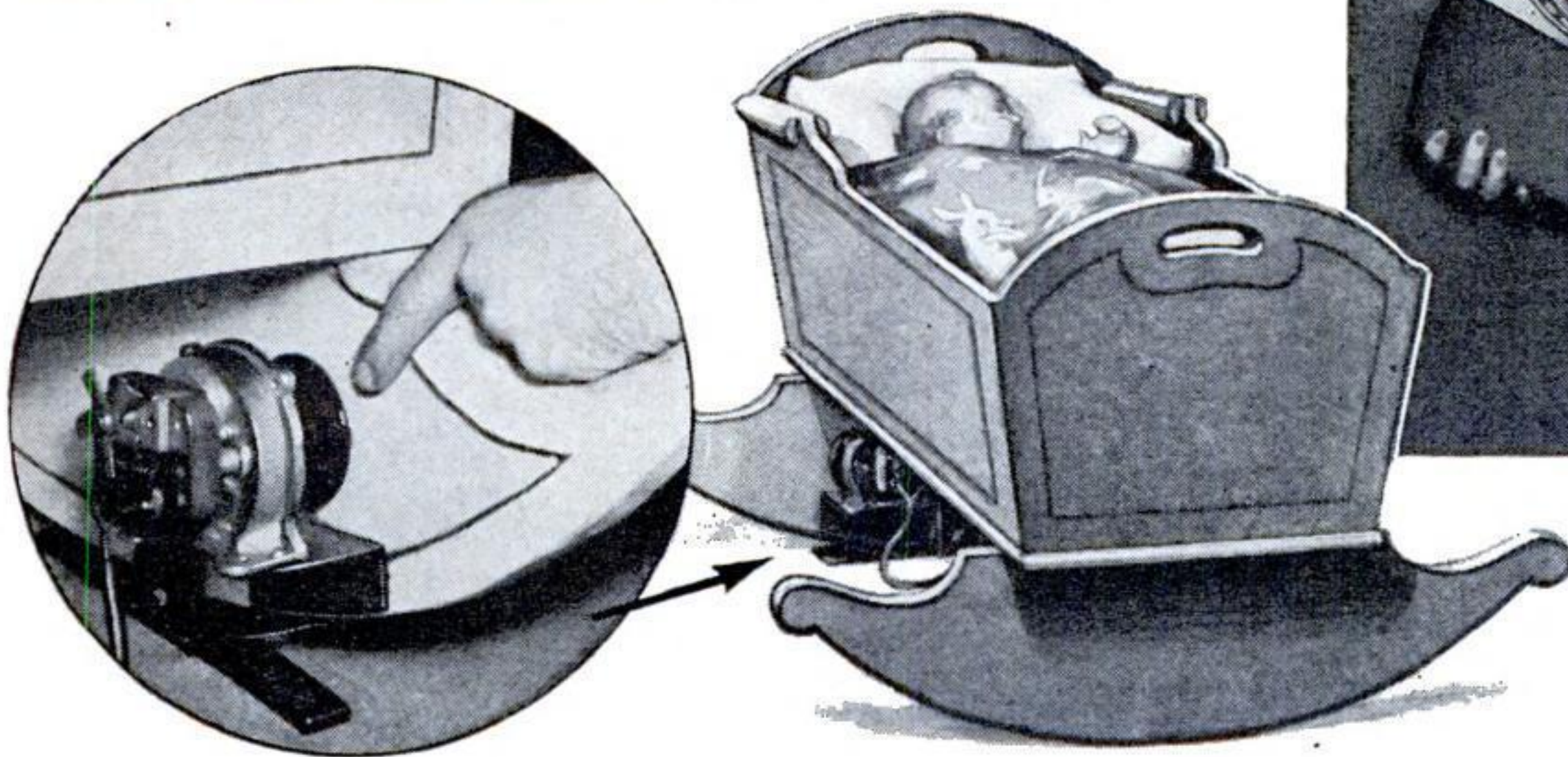
Golfer Turns Mermaid in Amazing Photo

LUCK, and an ultra-high-speed camera, enabled an English photographer to snap the remarkable action shot reproduced above. Showing a golfer on the Cleveleys course, in Lancashire, blasting a ball out of a flooded

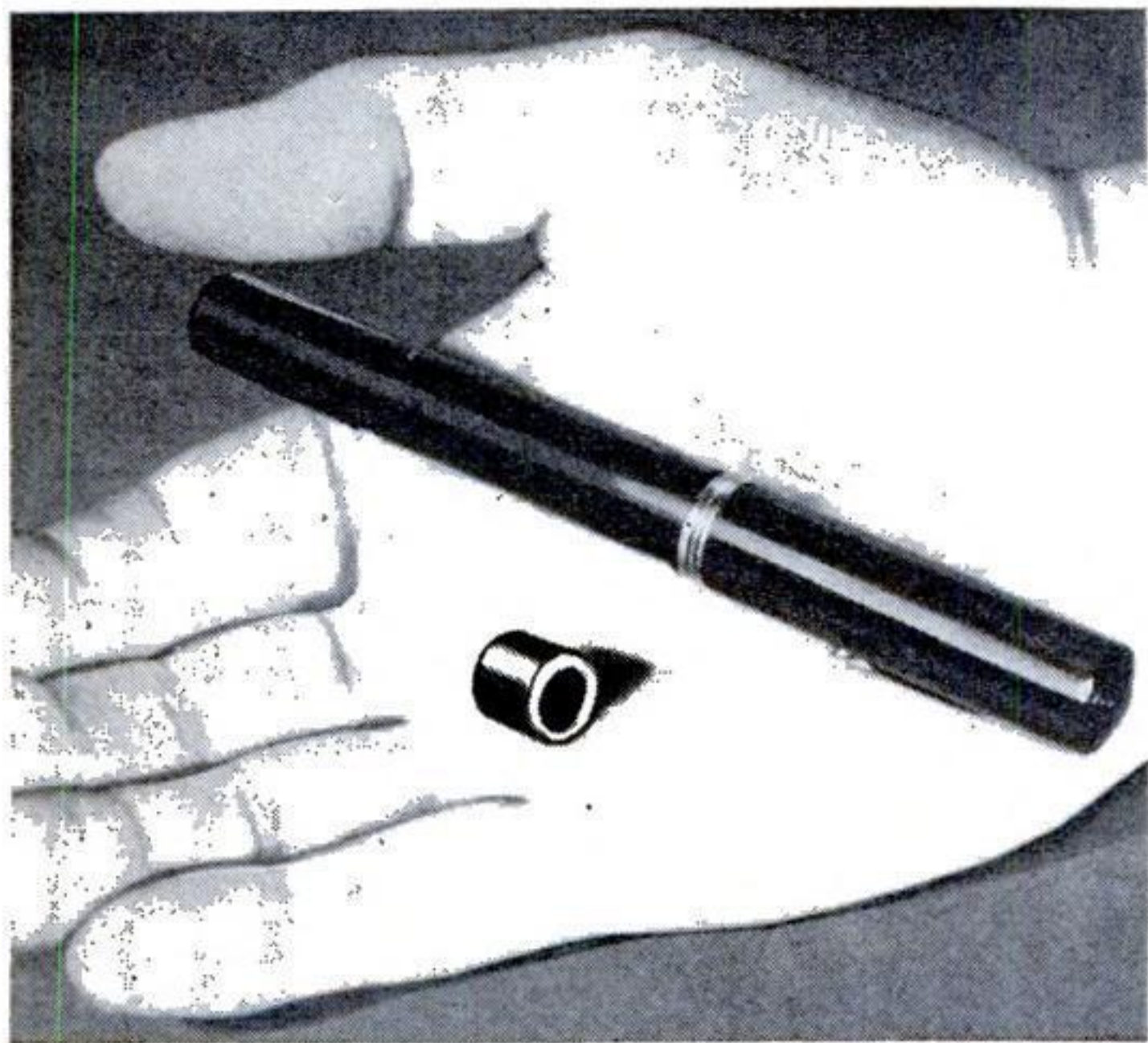
trap, the photograph caught the water splash seemingly framing the golfer's face, with myriad stray drops suspended in mid-air. Notice the depression in the surface of the water, caused by the sweep of the club head.

Remote Control Rocks Cradle

ROCKING a baby's cradle by remote control is one of the new and unusual uses for the "mystery control" now employed to tune a radio without being near the set (P.S.M., Sept. '38, p. 78). As pictured below, an electric motor is attached to a cradle rocker, with a metal arm that engages the floor, causing the crib to oscillate back and forth when the motor is switched on by dialing the control box from another room in the house. Other uses for the control include adjusting furnace drafts, and starting coffee percolators before arising from bed.



A motor attached to a cradle rocker, as seen at left, rocks the crib when the dial is turned on the remote control



Tiny Antifriction Bearing Uses "Needle" Rollers

MACHINE builders will be enabled to employ antifriction operation in cramped locations with the development of a new bearing which, in its smallest commercial size, has an outside diameter no larger than that of an ordinary fountain pen, as demonstrated in the photograph reproduced above. The diminutive bearing uses small-diameter "needle" rollers held in a single retaining shell.

Air-Conditioned Mattress

A WARM bed in winter, and a cool one in summer, are assured to owners of an air-conditioned mattress, according to its inventor. Controlled by an adjustable thermostatic device, a built-in electric heater and motor-driven blower circulate air through the inner-spring mattress at any temperature selected by the sleeper.



Built-in blower circulates air through the mattress

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On this vacant lot in San Marino, Calif., youngsters race motorized soap boxes around a tenth-mile track

Skidding around a turn, one of the roaring midgets hits the straightaway

BROADSIDING dangerously around the dusty turn, young Ace Weber poured on the juice and raced toward the finish. Dumpy Filley, eight-year-old starter, dropped the checkered flag, and Ace turned into the infield to receive as reward for his skill and daring a regulation crash helmet and goggles.

Ace is thirteen, and he drives a midget car

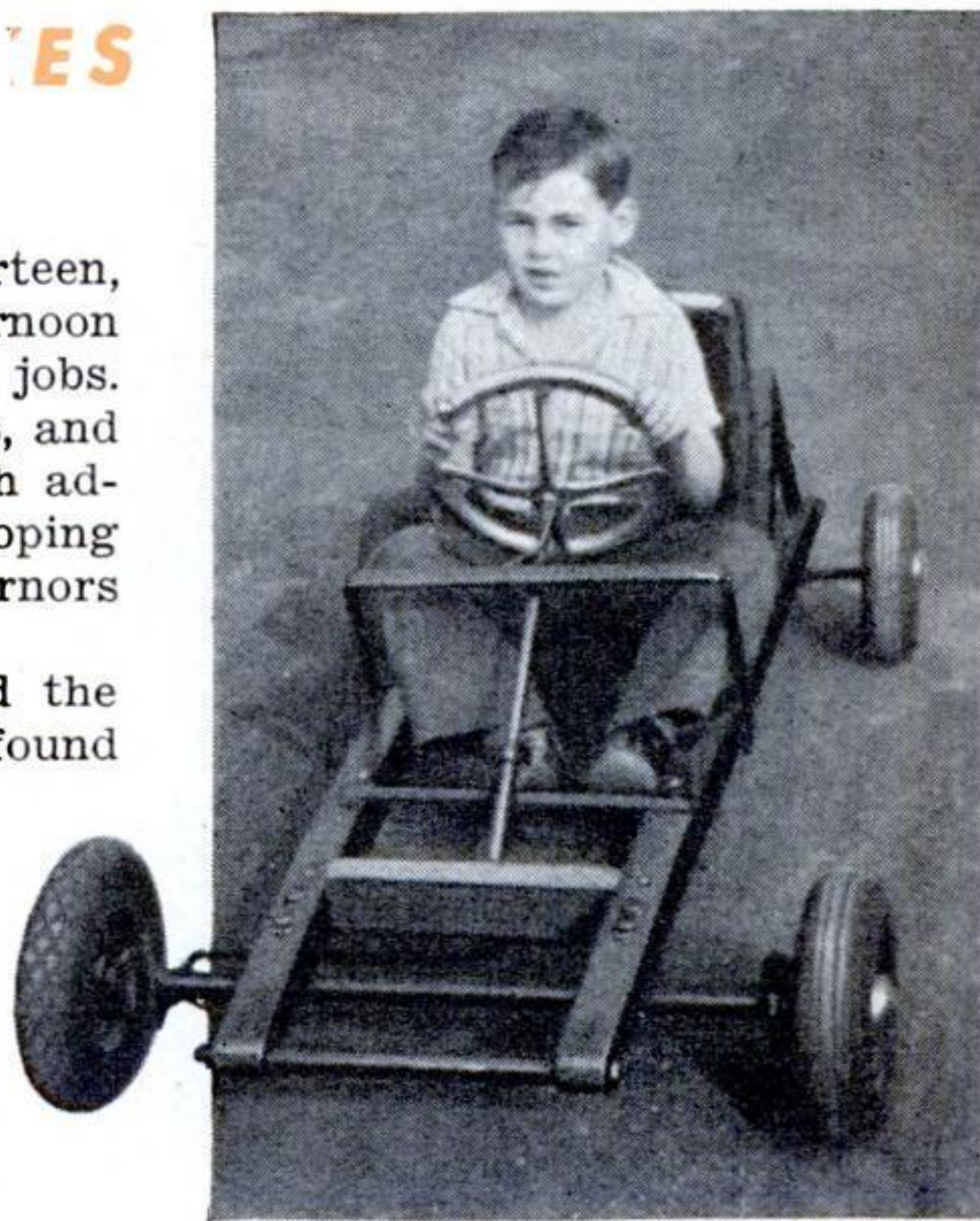
powered by a one-horsepower, air-cooled engine which once pulled a cultivator through the soil on a near-by estate. His little bus will hit thirty-five on the straightaway, Ace assures you, although on the one-tenth-mile dirt track in San Marino, Calif., he can scarcely better twenty-five in the brief straight runs. Too, the turns have been left unbanked, which cramps his style considerably.

ES

Ace and a group of boys ranging from six to fourteen, not counting a few girls, meet every Sunday afternoon to test the speed and power of their tiny homemade jobs. They call themselves the San Marino Midget Racers, and compete seriously for the helmet and goggles, with additional weekly gasoline prizes. No engine developing more than two horsepower is permitted, and governors and chokes hold down speed on the sharp turns.

The operator of a local service station founded the racing association for the youngsters when police found it difficult to keep the roaring soap boxes off the city streets. He laid out the short track on an empty lot and promised prizes provided the boys would keep off the public thoroughfares, help keep the track in condition, and maintain their school work at a satisfactory level.

All the boys built their own cars, with help from parents and friends. On the track, the collection of racers presents a strange appearance. Spinner



Tommy Tupman, just seven and a half, drives an open model like a scooter. It can do forty-eight miles an hour



Pushed by fathers and friends, entries get a race-horse start around the dirt track. Governors and chokes hold the cars to a safe speed



At the finish line, starter Dumpy Filley prepares to whack the winner over the head with his flag

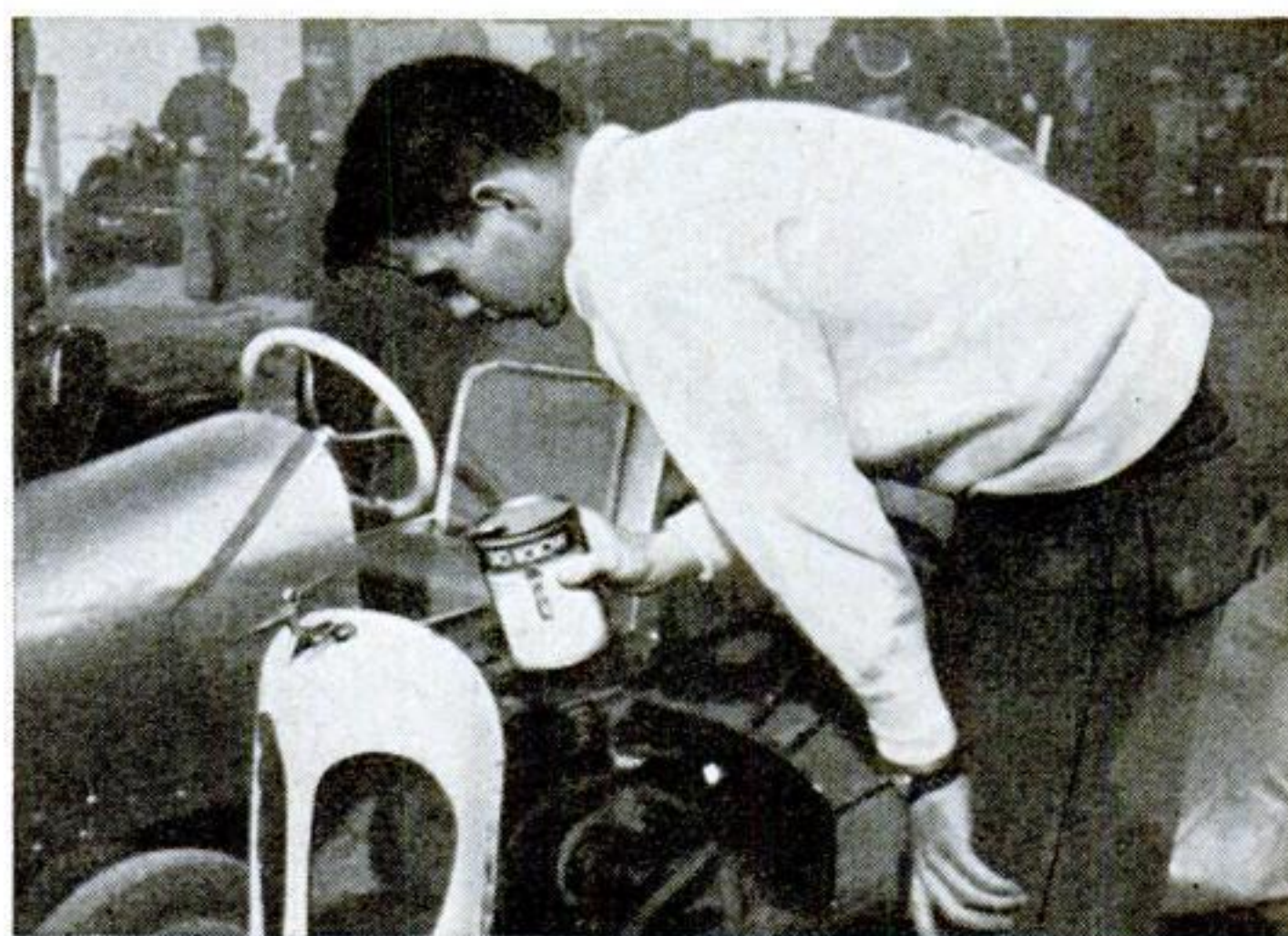
Patten's "open work" model, for example. Spinner paid three dollars for a small motor, which he mounted behind the wicker seat and connected directly to the rear wheels. Spinner's mechanic pushes him down a near-by alley to get the car started, and the driver pilots the little racer up an incline and onto the track.

The boys pick up motors around the neighborhood and adapt them to individual cars. Some of the makeshift power plants once turned washing machines; others operated small pumping plants; a few drove lawn mowers. Average cost of a car is sixty-five dollars, including inflated rubber tires, turned-down spindles from small automobiles, sturdy steering gears, and front assemblies.

Qualifying races precede the weekly helmet event, four cars running in each heat. More than one driver has lost a wheel, careened through the string fence with a blowout, or stalled his motor in front of a roaring pack. The principal danger, the boys assure you, comes not on the turns nor in crowded starts, but at the finish. There Dumpy Filley, who answers more formally to Dwight, brings down the finish flag smack on the winner's head. Which is a small price to pay for a chance to wear a real helmet during next week's races, and perhaps to keep it.



Batteries under the hood of the one electric racer



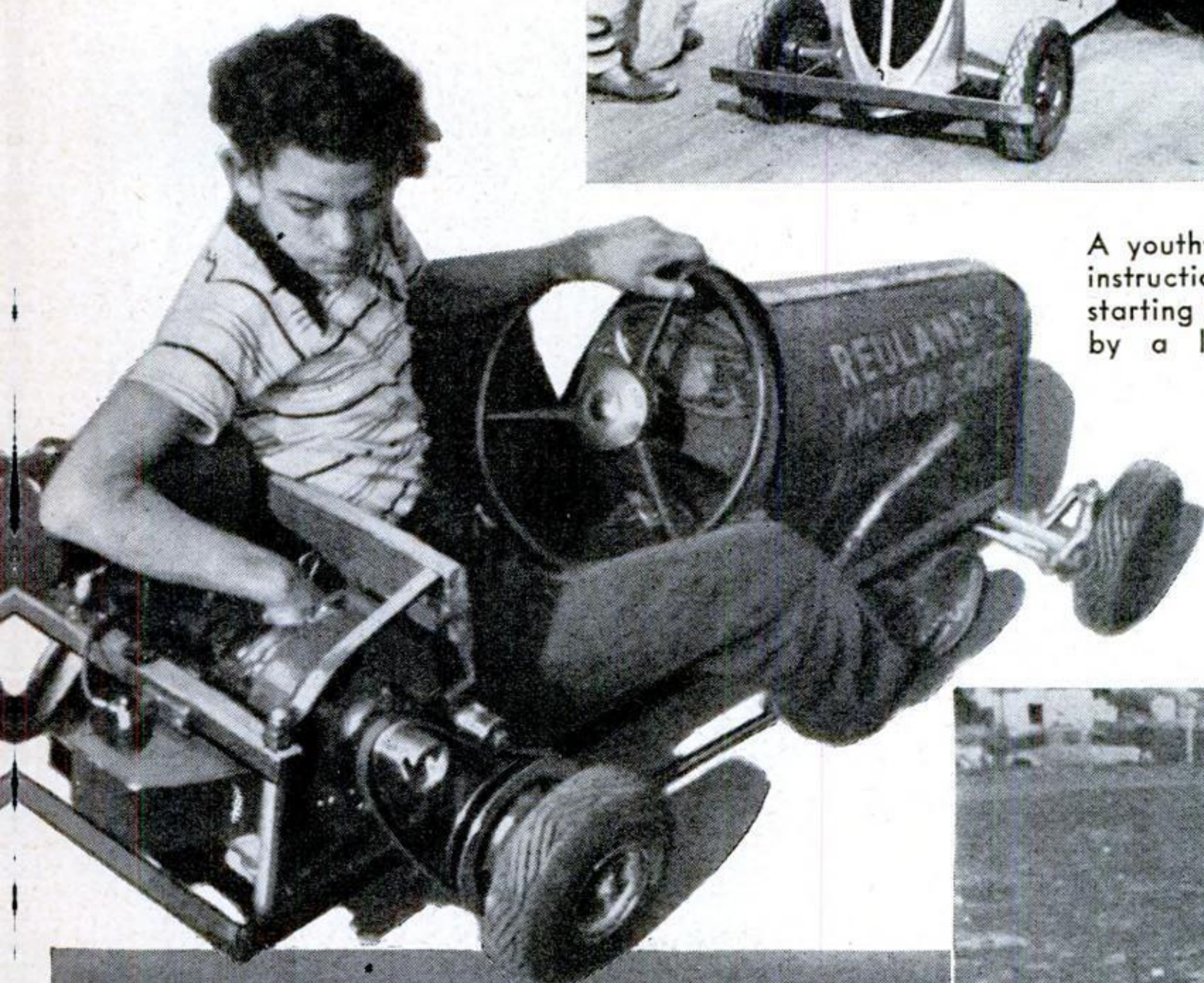
A contestant filling his fuel tank from a quart can

Seven-Year-Olds Hit the Roaring Road in Motorized Soap Boxes To Chase Thrills on a Pygmy Speedway

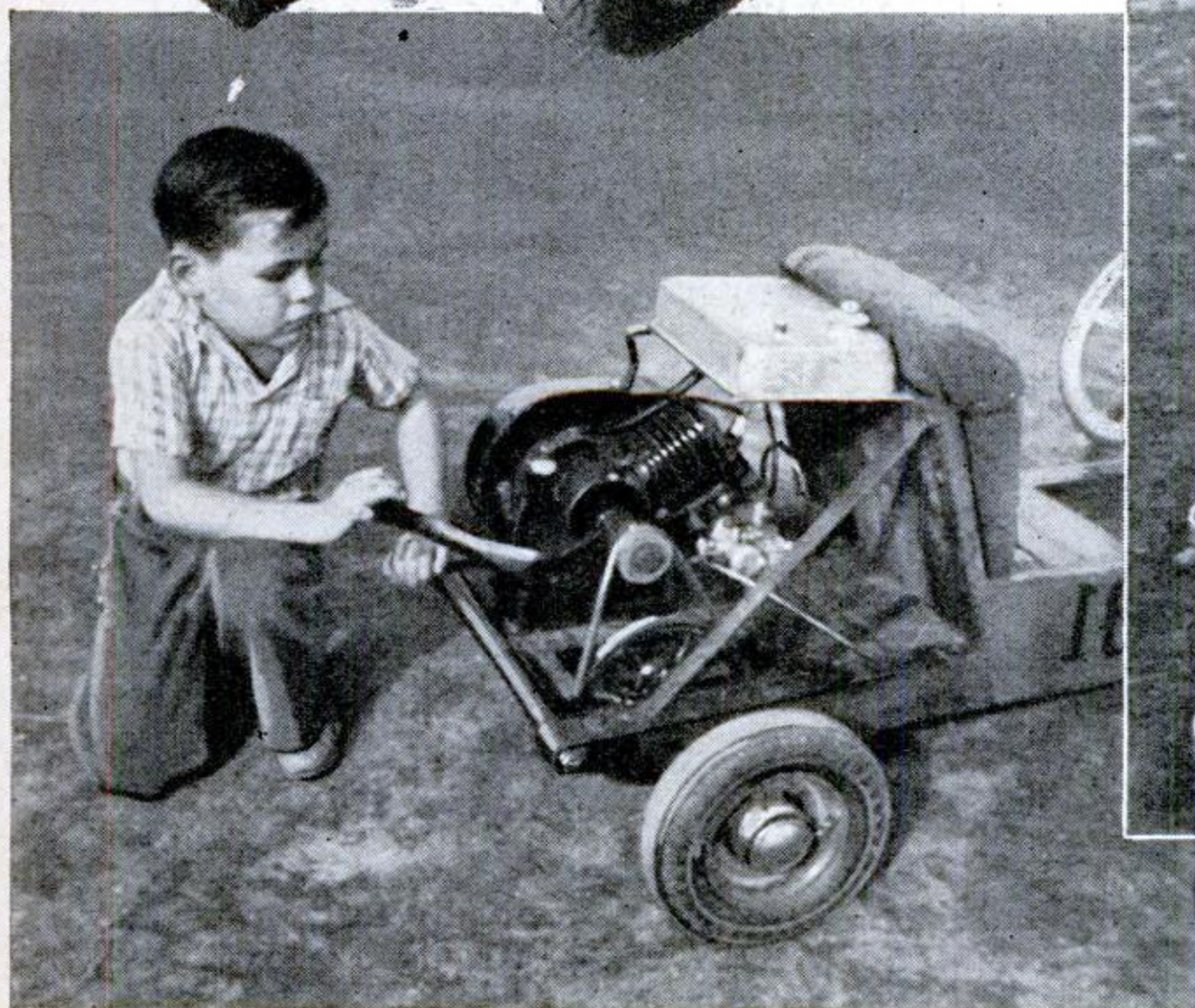
Below, John D. Cogswell is making an adjustment on his motor, which once powered a pipe threader for a plumber



A youthful driver receiving last-minute instructions from race officials before starting the grind. Races are sponsored by a local service-station operator



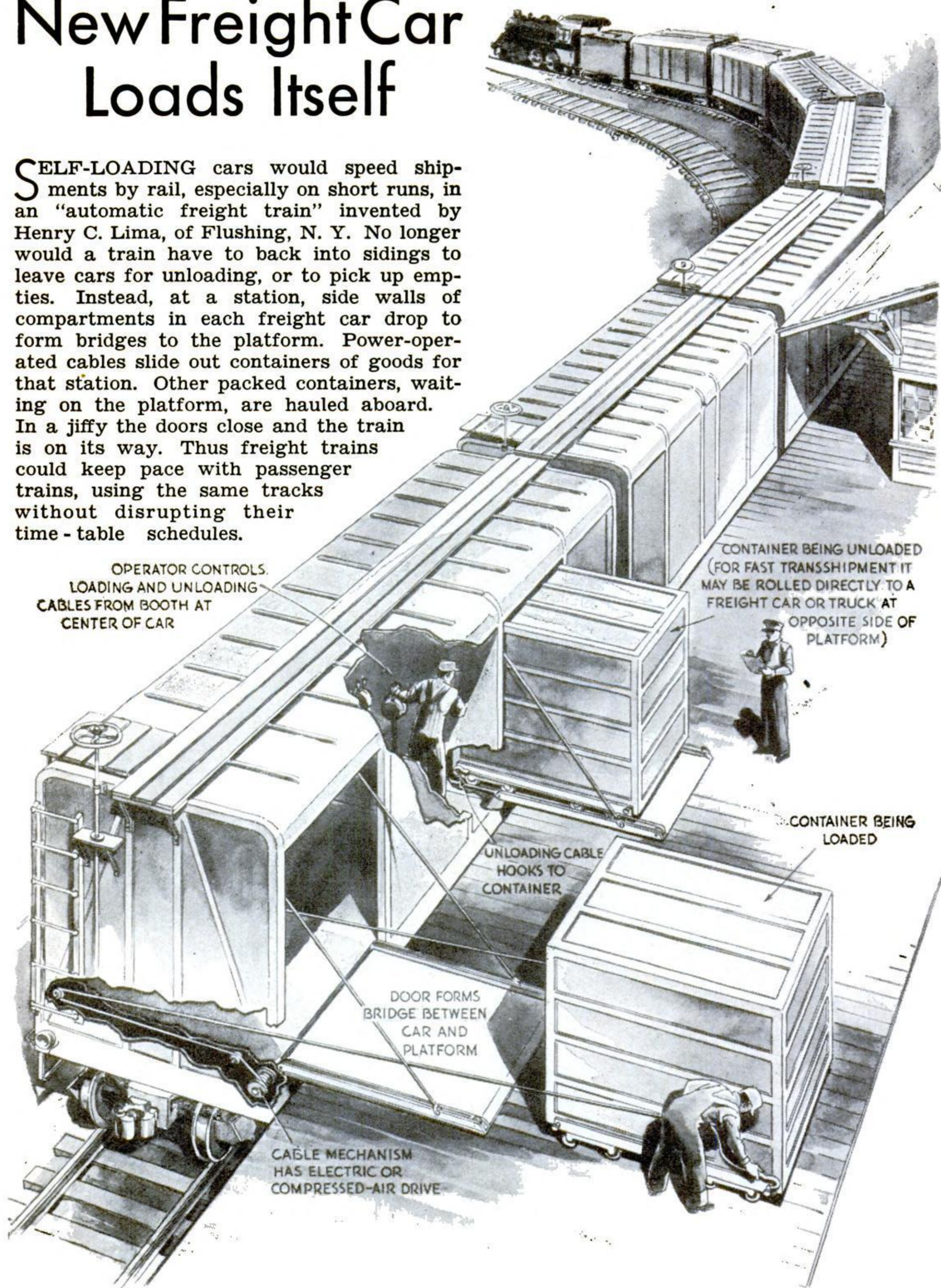
Below, Ace Weber is wearing the professional crash helmet awarded to winners. His one-cylinder engine is set just above the rear wheels



Tommy Tupman is seen at the left, giving loving care to the fifteen-dollar motor that got him first place in his first race

New Freight Car Loads Itself

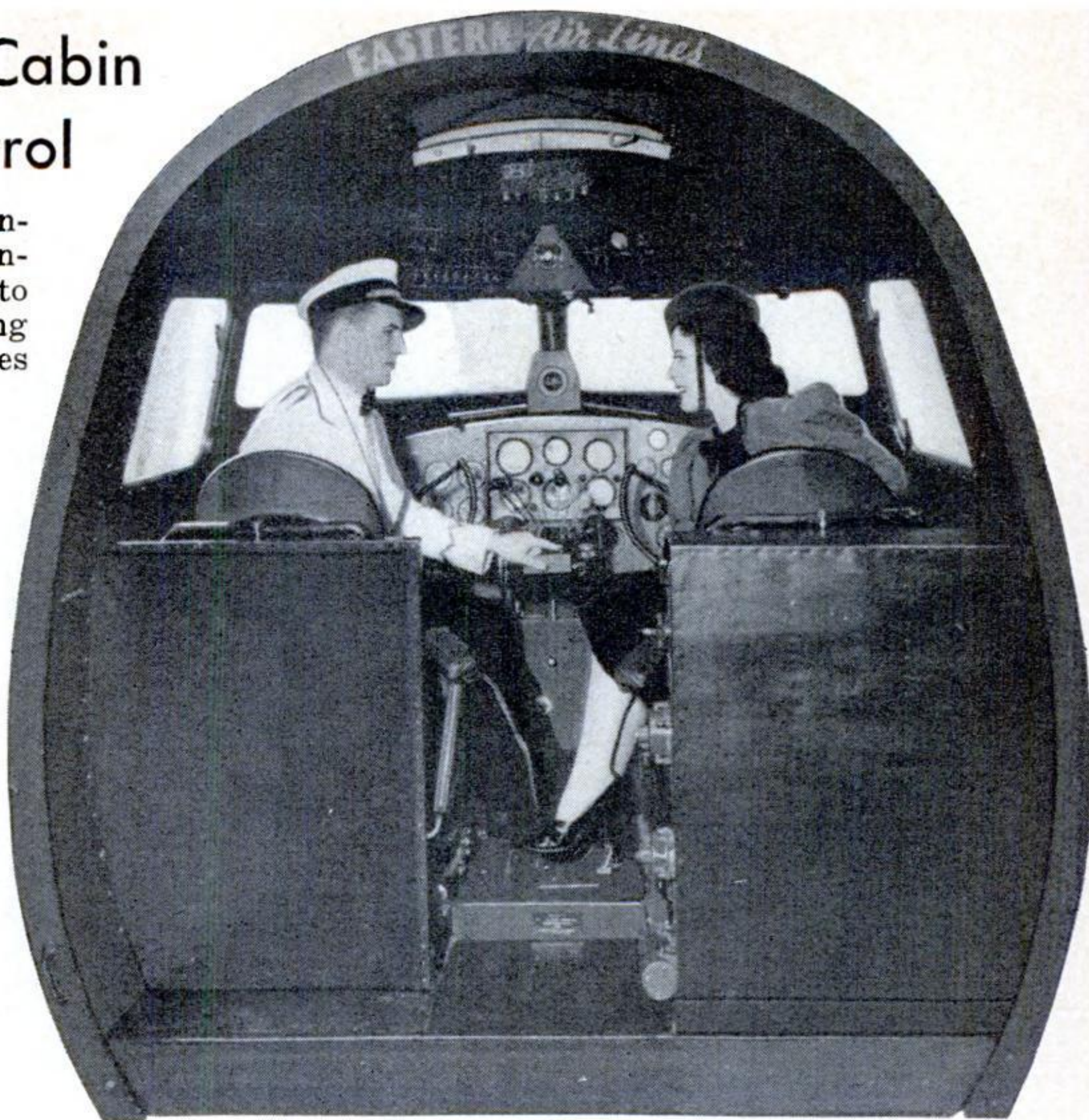
SELF-LOADING cars would speed shipments by rail, especially on short runs, in an "automatic freight train" invented by Henry C. Lima, of Flushing, N. Y. No longer would a train have to back into sidings to leave cars for unloading, or to pick up empties. Instead, at a station, side walls of compartments in each freight car drop to form bridges to the platform. Power-operated cables slide out containers of goods for that station. Other packed containers, waiting on the platform, are hauled aboard. In a jiffy the doors close and the train is on its way. Thus freight trains could keep pace with passenger trains, using the same tracks without disrupting their time-table schedules.



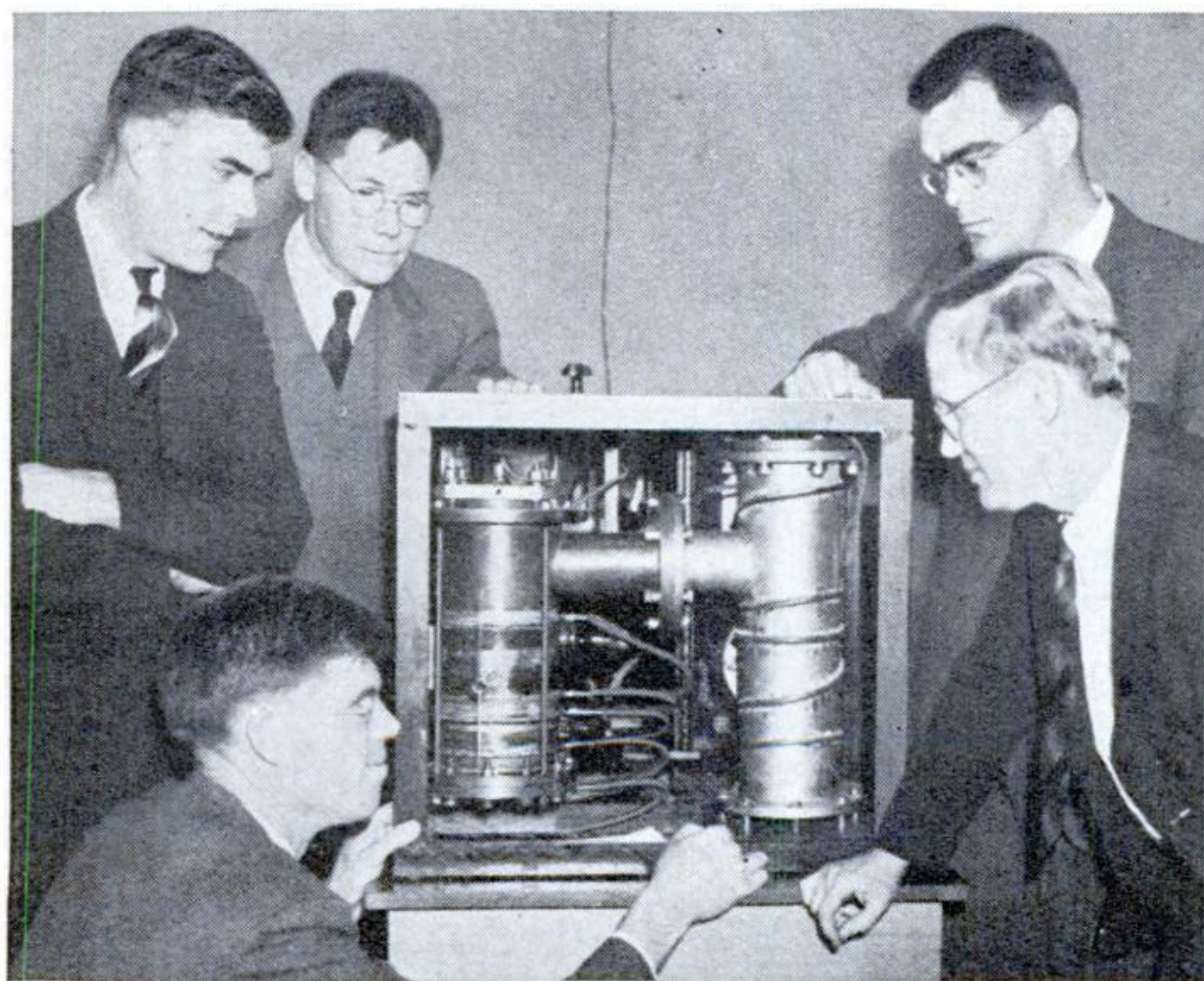
How the "automatic freight train" would discharge and pick up freight. Power-operated cables slide the loaded containers out onto the platform, and drag others into empty compartments, allowing quick get-away

Dummy Plane Cabin Shows Control

TO FAMILIARIZE the general public with the scientific apparatus available to airplane pilots for guiding scheduled transport planes with the maximum of safety, a major American air line has constructed a mock-up, or wooden dummy, of a standard control cabin, with all the array of dials, gauges, levers, and other apparatus that is standard equipment on large transport ships. On display in many of the chief cities throughout the country, the exhibit is in charge of a uniformed flight steward and is usually connected by a special telephone line to a near-by airport so that visitors may listen in to actual plane-radio conversations.



A visitor gets an idea of a pilot's job in the demonstration control cabin

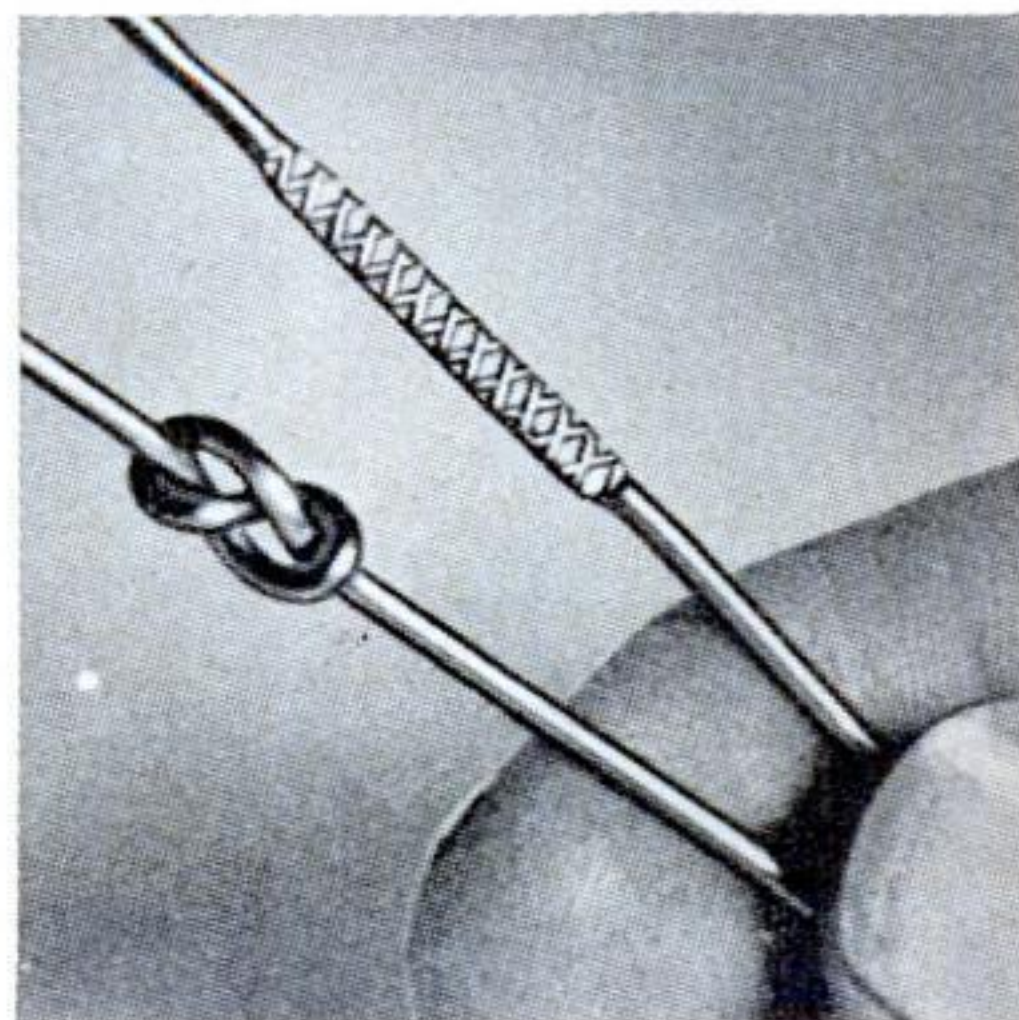


Shorter Short Waves for Radio

ULTRASHORT-WAVE radio apparatus that can send and receive signals on a frequency of 1,000,000 kilocycles has just been announced in California by three young Stanford University scientists. The device produces powerful, four-inch waves which, unlike most ultrashort waves, can be controlled as easily as searchlight beams.

Plastic Insulation for Magnet Wire

ELECTROMAGNET wire of a new type is coated with a synthetic-resin insulation said to be much tougher, more flexible, and less bulky than the insulating coatings of enamel now in general use. In the photograph below, two samples have been severely twisted and pressed, without breaking the plastic outer insulation.



Hobby Doctor



Carl Anderson at work at one of his own many hobbies

BESIDE the paved county road at Vineburg, Calif., in the section made famous by Jack London as the Valley of the Moon, stands a queer shingled building that houses what is perhaps the only institution of its kind in the world—a hospital for hobbies. Equipped with a wood lathe, woodworking tools, portable forge, welding torch, and other necessities for tinkerers, the unique “craft laboratory” is open without cost to any man or boy in the valley who needs its facilities in the pursuit of his spare-time activities.

Back of this unusual service to hobbyists, as might be suspected, is a rare personality. Carl Anderson, the “doctor” of the odd craft clinic, has been an amateur ventriloquist for forty-eight years. As a boy of twelve, plowing on an Illinois farm, he amused himself by “throwing his voice” to one side or the other to fool his team. Ever since, through a long and active career, he has devoted his leisure moments to perfecting his technique as a ventriloquist and to building his own dummies. Recently, as publisher of a weekly newspaper at Vineburg, he discovered that the Valley of the Moon contained more than fifty persons who were interested in home



Anderson's “craft laboratory” at Vineburg, Calif. Open to enthusiasts from all the surrounding country, the building is fitted with power tools and other facilities which the amateurs can use without cost

GIVES FIRST AID TO AMATEUR CRAFTSMEN

By **ROBERT E. MARTIN**

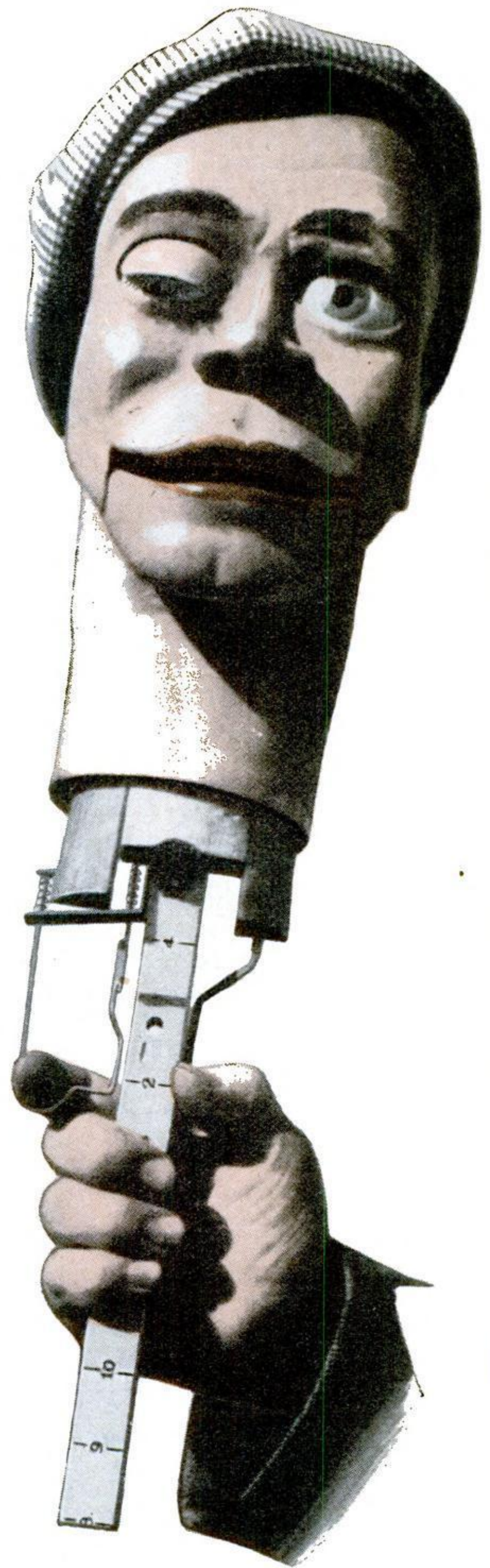
crafts and pastimes, and that many of them were hampered by the lack of proper tools and materials.

That gave him an idea. Leasing his newspaper, he established his craftwork laboratory and hung out his shingle as a hobby doctor. Freed from the routine of the print shop, he now gives his time to help amateurs complete their brain children. If they cannot bring their problems to the hobby hospital, he loads his little car with a portable forge, a gripful of tools, wood, glue, and other materials, and makes a "call." Anywhere you may go in the valley, some one will tell you that Carl Anderson has come by recently, helping some hobbyist along the road to success.

Visit the craft laboratory, and you are likely to find Robert W. Morris, an eighteen-year-old high-school junior, putting the finishing touches on a tiny one-cylinder gasoline engine that turns

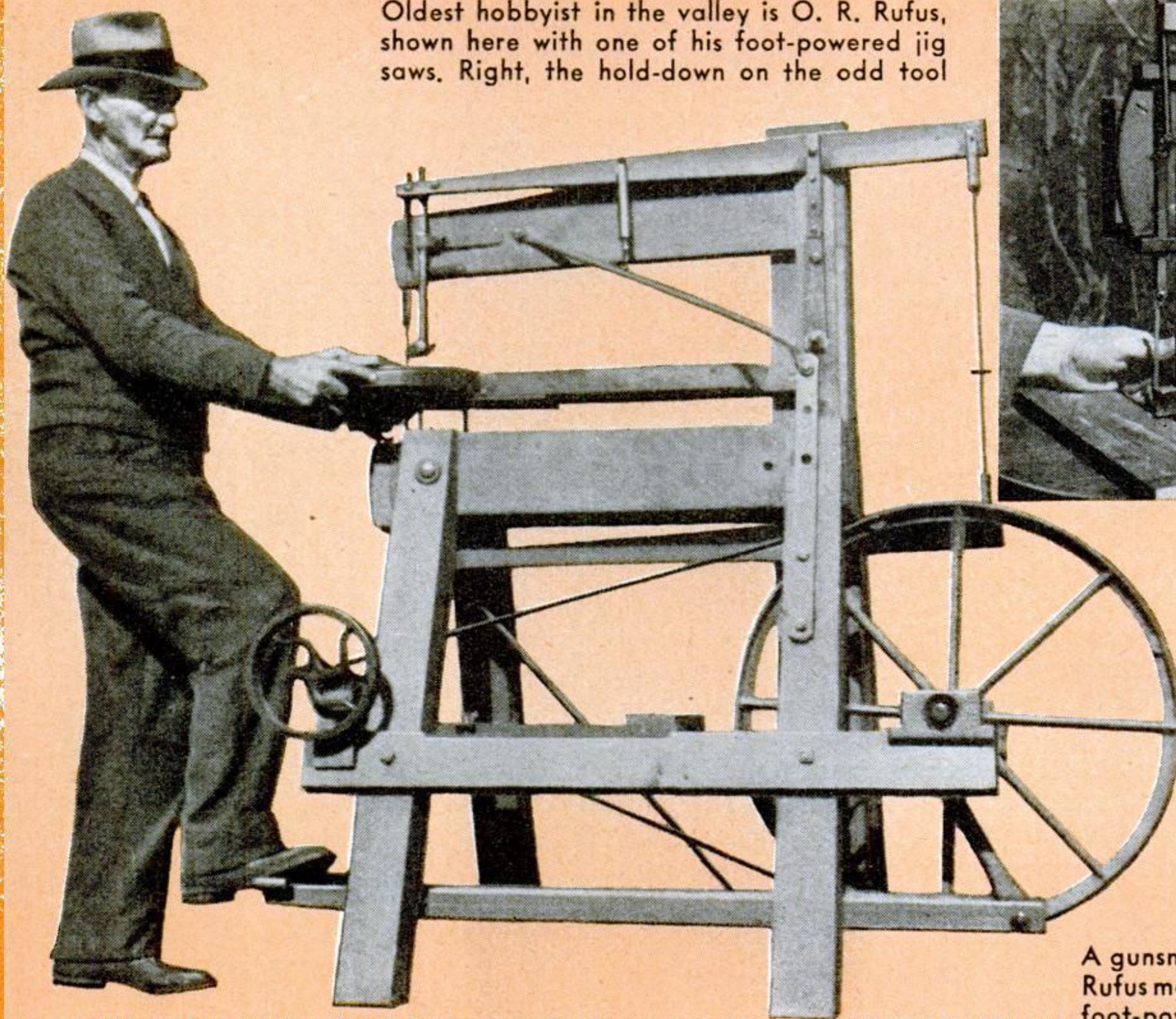


JULY, 1939



An amateur ventriloquist himself, the "hobby doctor" here displays his newest homemade dummy, an accomplished puppet that rides a tricycle and winks gravely when the controls are operated as shown above. The eyes are of wood

Oldest hobbyist in the valley is O. R. Rufus, shown here with one of his foot-powered jig saws. Right, the hold-down on the odd tool



A gunsmith by trade, Rufus makes hand and foot-powered tools

up 5,000 revolutions a minute. Some day, when Robert and Anderson find time to put the wings together, the five-ounce motor will power a model airplane. Robert likes to tinker with machinery and engines, large or small. He has hooked a nine-horsepower motor-cycle engine to a shortened automobile differential and rear axle, to make a power mower for cutting the tall grass around the school grounds. In his work at the laboratory, Robert doesn't have to worry about anything except the materials he uses. Everything else, Anderson insists, is "on the house."

At the other extreme of the hobby trail you might encounter O. R. Rufus, eighty-year-old gunsmith. Building hand and foot-powered machine tools is Rufus's idea of relaxation from making guns. At the craft laboratory I saw a small jig saw he made "forty or fifty years ago," which still gives good service. In the barn back of the Rufus gun shop I saw the modern big brother of that tool—a wooden jig saw in which Rufus has incorporated a hold-down like those on band saws, and a blower made out of a bicycle pump, which puffs away the sawdust from hardwood used in making gun stocks. To steady the saw and keep it moving up and down at an even rate as the foot treadle is pumped, a large flywheel turns on ball bearings.

Not long ago, Rufus completed a double-knife

Eighty-year-old O. R. Rufus with a homemade jig saw he has been using for forty or fifty years. In spite of its age, it works well



bolt cutter. "They said I couldn't do this," he grinned, slipping a three-quarter-inch bolt between the jaws, "but I tapered the blades and made them meet on a square shoulder." As he spoke, the two knives clipped the head from the bolt. A lead counterweight held the long handle up until he was ready to apply hand pressure, "so it won't fall and hit me in the back," he explained.

Another "client" who has been encouraged by Anderson to develop a hobby is W. J. Patterson, young Sonoma dentist. When he first settled in the valley, Patterson got tired of looking across the town square while waiting for patients to show up, and wanted some way to keep his fingers active. "Why not build a model-railway system?" Anderson asked him. The dentist liked the idea, and installed 00-gauge tracks on a shelf around the inside walls of his garage. He also started building his own rolling stock and in two years has constructed fifteen freight cars and eight coaches—"mostly between patients." His tools are largely dental instruments.

Six years ago, J. R. Thomas came to Sonoma and set up a blacksmith shop. "When you're not shoeing horses," Anderson suggested to him, "why not try your hand at fancy wrought iron?" As a result, Thomas now turns out scores of andirons and other metal specialties, decorated with the searing flame of the blowtorch.

Another successful amateur who owes his early encouragement to Anderson is Henry Lutzenburg. In his travels around the valley, Anderson became acquainted with the young grocery clerk and urged him to try his hand at building furniture. Lutzenburg's second effort, a gum table inlaid with 857 pieces of mahogany, sagebrush root, maple, and walnut, won him first prize at the state fair.

While helping others to find pleasure and profit in spare-time activities, the hobby doctor of the Valley of the Moon keeps at his own pastime of "trying to be a ventriloquist." Assisted by a talented dummy that can ride a tricycle and wink wisely, he entertains public gatherings all over the valley. As long as he can do that, and his craft laboratory echoes to the sound of enthusiastic workers, he is happy.

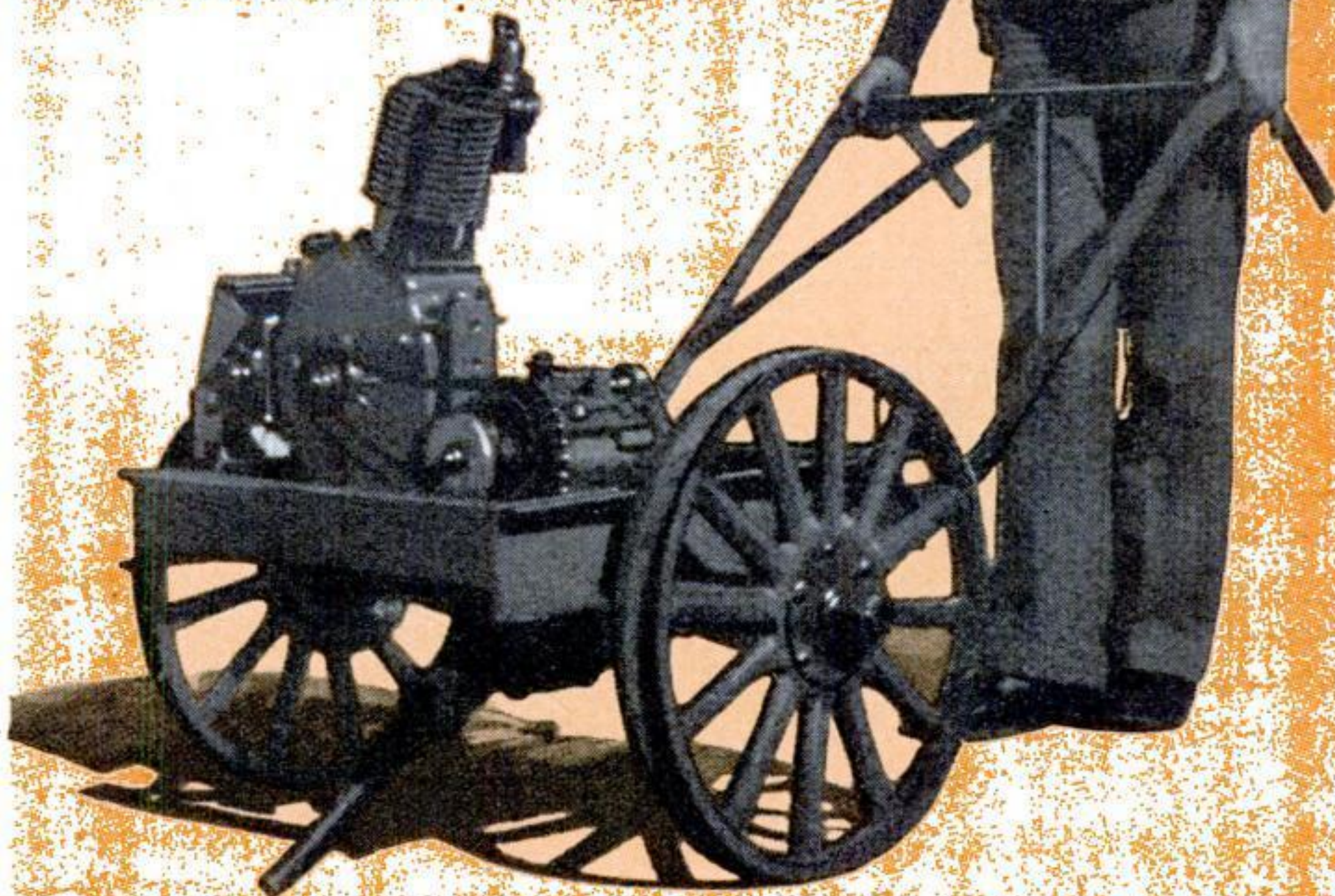
"It's about time I was helping these fellows along," he told me. "Most people don't know what they're missing until they take up a hobby."



This five-ounce gasoline engine was built by Robert W. Morris, to power a model airplane



J. R. Thomas, blacksmith, took up ornamental iron work at Anderson's suggestion



Morris with the gasoline-powered mower he built for his high school



Dirt and boulders form stripes in the vast Malaspina Glacier, in Alaska. Dark borders are forest growths



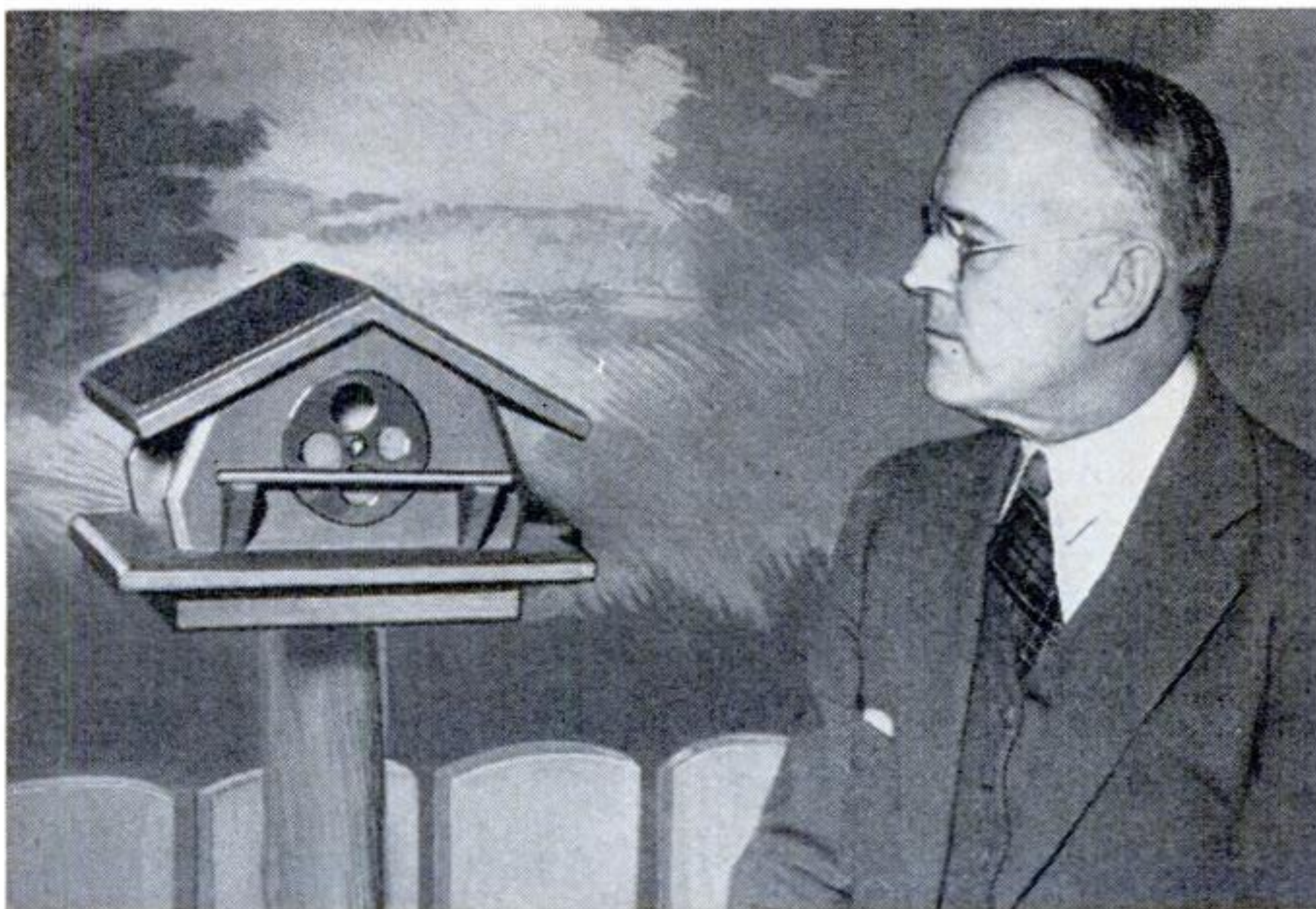
Setting up a lighted marker for clocking the glacier's speed

Clocking the Speed of a Glacier

HOW fast does a glacier travel? Bradford Washburn, leader of a joint expedition of Harvard University and the National Geographic Society, recently answered this question with reference to the Malaspina Glacier, in southeastern Alaska, by putting a "speedometer" on the huge river of ice. On the surface of the glacier he set up a battery box surmounted by a black tube and a flash-light bulb. With a theodolite set up on a spot beside the glacier, he sighted at the marker every three hours, using the black tube as a target by day and the lighted bulb by night. By measuring the angles by which the marker had shifted, he found that the glacier surged forward from one to two inches an hour on fair days, and about half as fast in the rain. The expedition reported that it had also discovered that the glacier is the point of outlet of an ice field 235 miles long, the largest ever discovered outside the polar regions.

"Dial" Bird House Suits Any Tenant

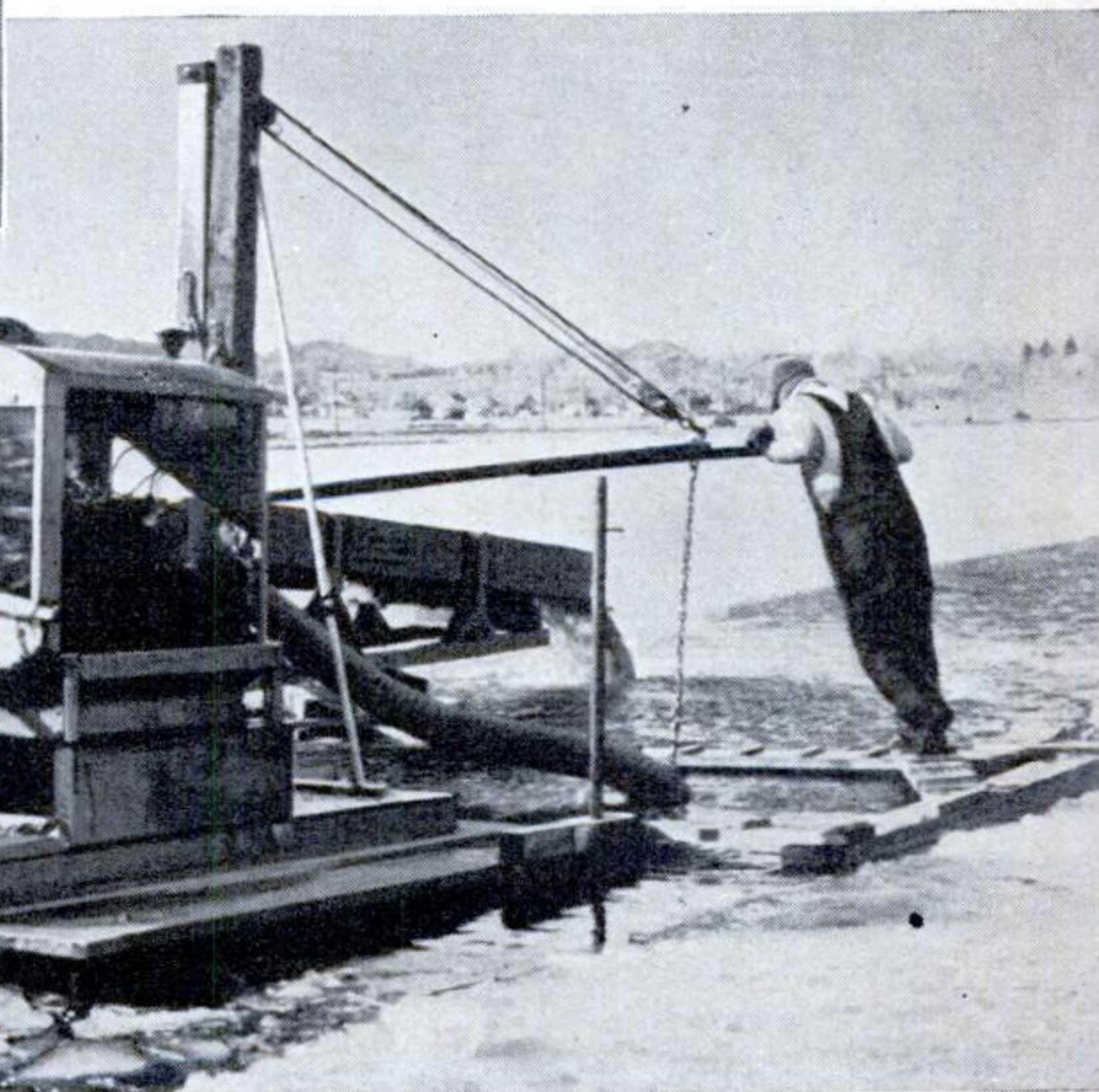
CONSTRUCTING bird houses is the hobby of Thomas Corrow, of Swampscott, Mass., shown at the right examining a new type of house which he designed. Called by its maker a "dial" bird house, the wooden nest is fitted with a revolving door panel containing four openings of different sizes to permit the unit to accommodate a wide variety of birds. A cylindrical bar mounted in front of the circular door serves as a roost for the feathered inhabitants.



Turning the "dial" door panel adapts the house for various birds

Mine Lead from Lake Bottom Near Trap-Shooting Range

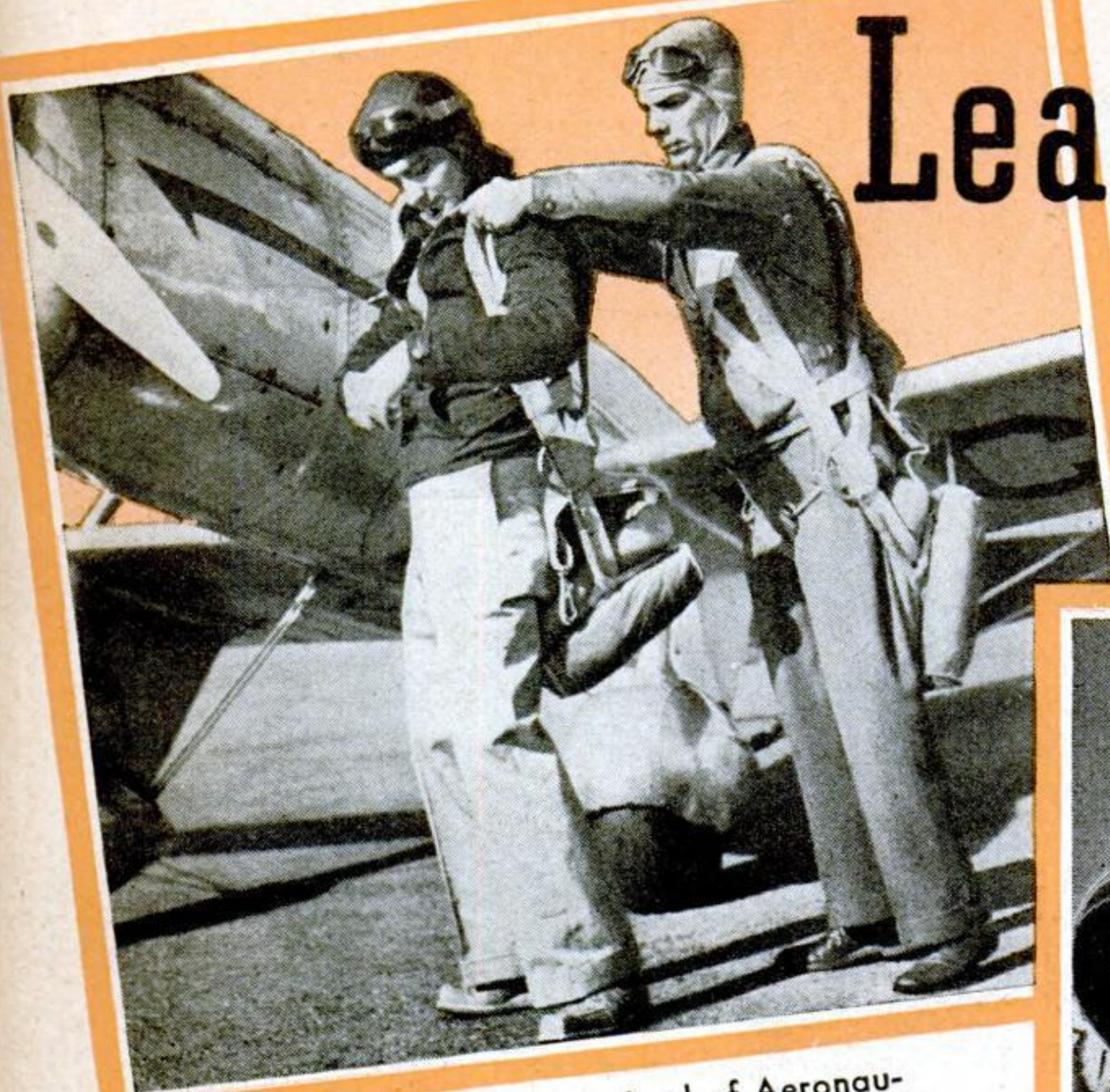
WHATEVER goes up must come down, figured Jack Edwards, of Denver, Colo. Trap shooters at a local range had been firing at clay pigeons over a near-by lake for twenty-seven years, and Edwards calculated that they had deposited at least 150 tons of lead on the lake bottom. He presented his idea to Daniel Winters and Harold Roberts, two unemployed workers, and they are now busily mining the lake with the aid of a suction pump powered by an old gasoline engine. Their operations are enabling them to reclaim approximately a ton of lead a day, at sixty-five dollars a ton. Roberts is shown at the left examining reclaimed lead. The mining set-up is pictured below.



Pumping lead-filled sludge from the lake bottom. Inset shows one of the "miners" examining salvaged shot

Learning To Fly

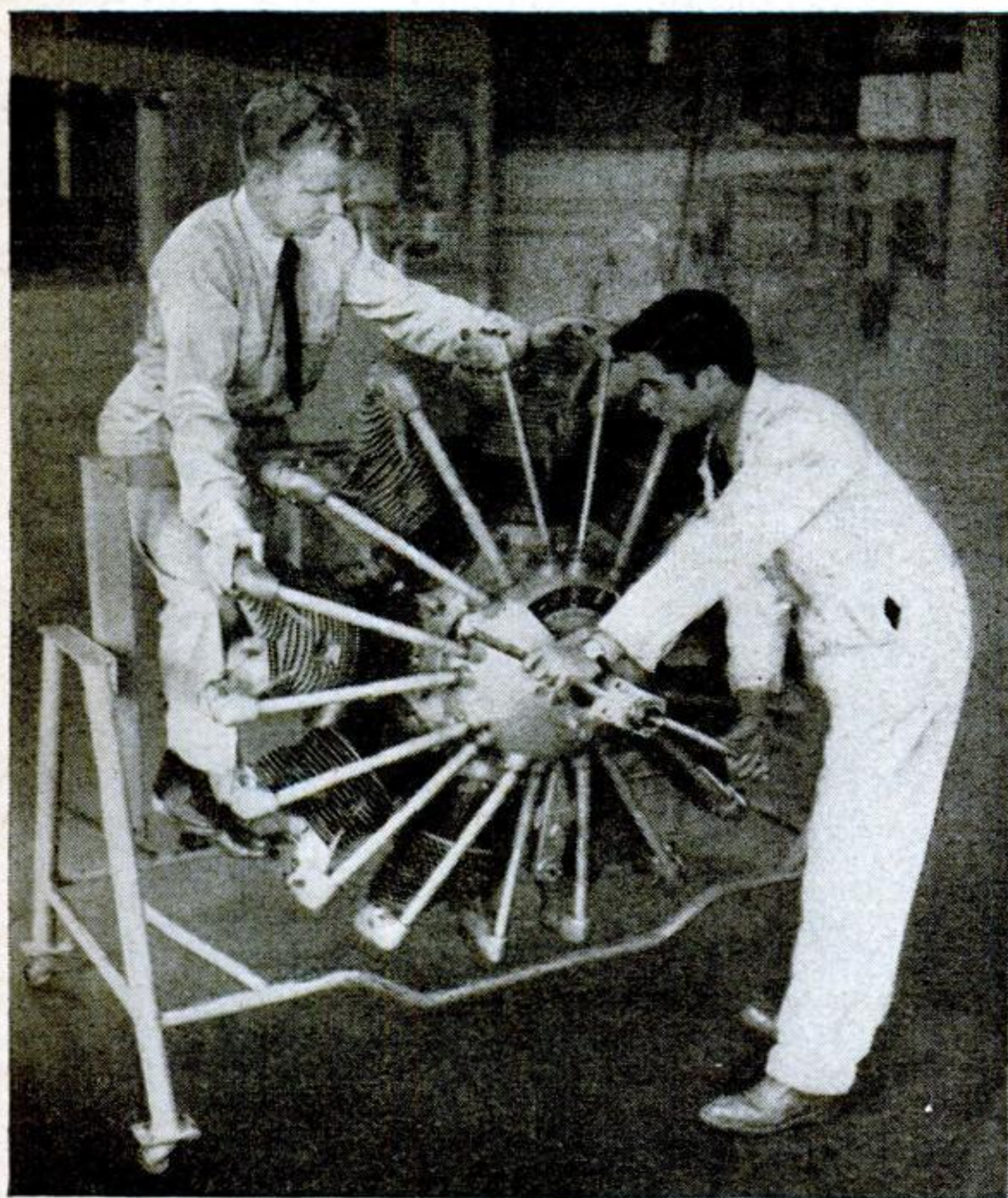
HOW FLEDGLING PILOTS
WIN THEIR WINGS AT A
MODERN AIR COLLEGE



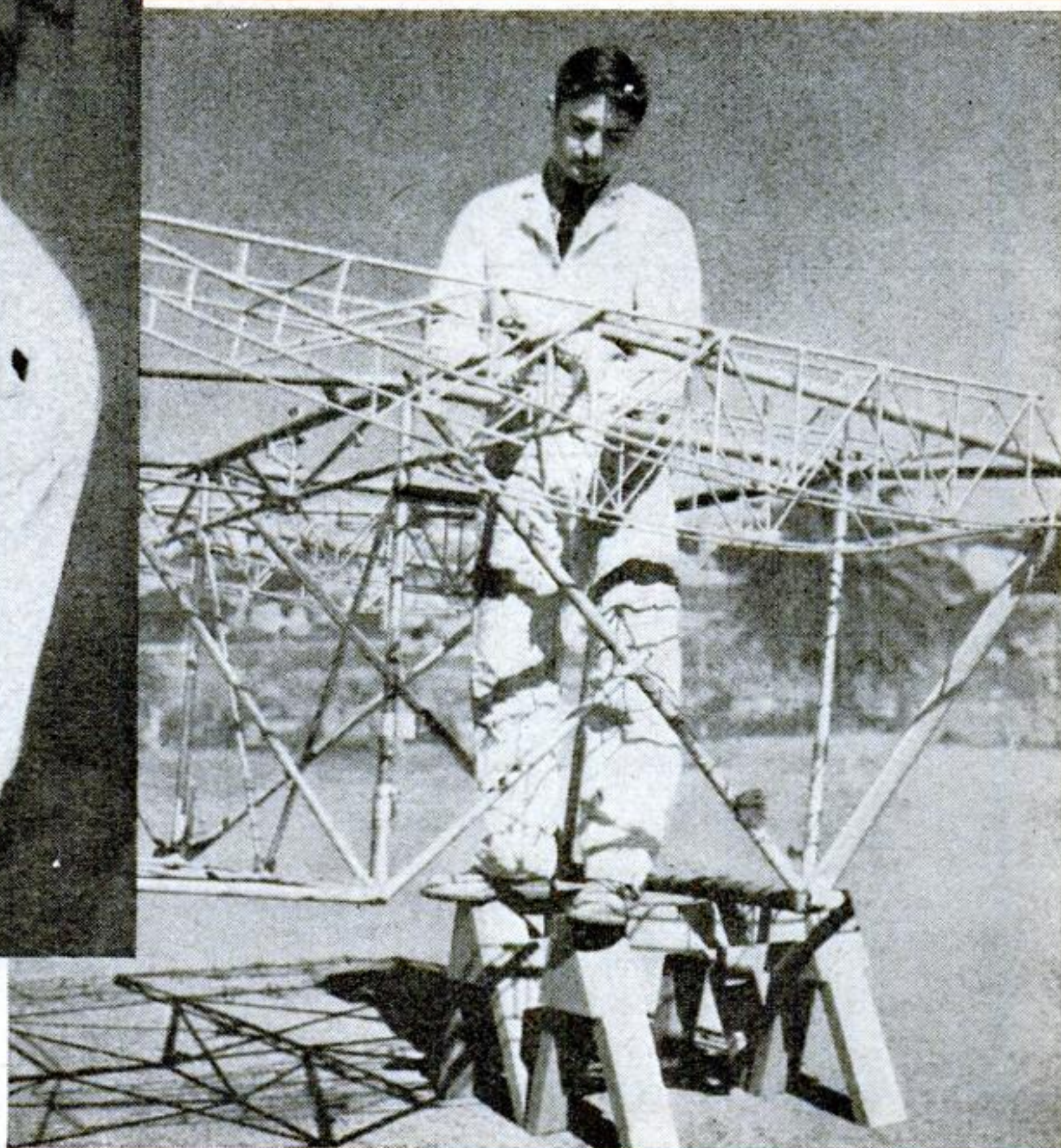
A "freshman" at the Kyan School of Aeronautics, San Diego, Calif., getting into his parachute harness for his first trip aloft. The instructor handles the ship in taking off and landing, turning the controls over to the beginner for short periods while the plane is in the air



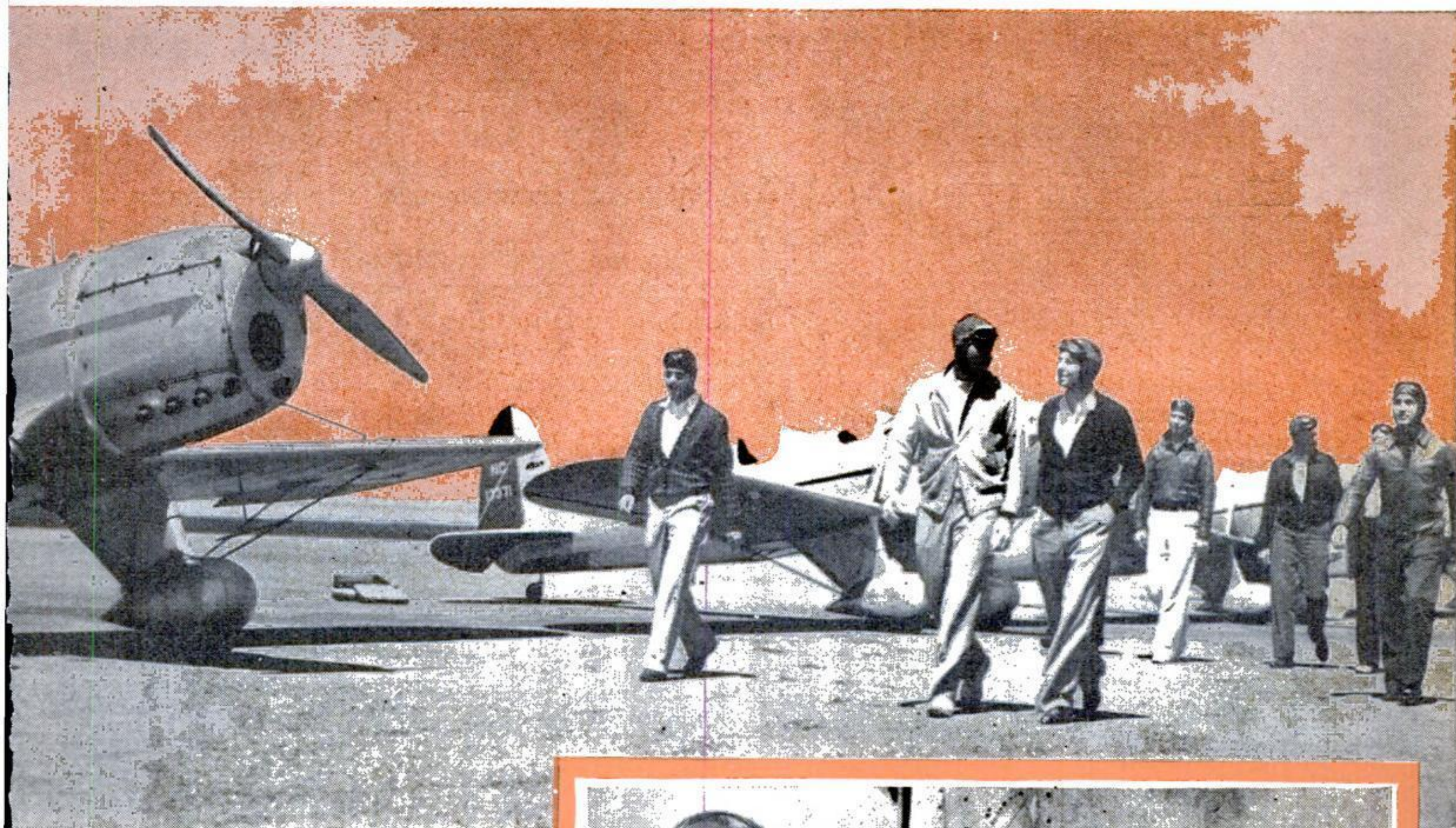
Through a speaking tube, the student can receive orders and advice from the instructor, but can't talk back. Below, learning how strong the framework of a plane is, by helping break up an old one



Flying begins and ends on the ground, as a pilot's behavior in the air—especially in an emergency—may depend on his knowledge of his ship and its engine. Here the tyro is learning what makes a radial engine tick



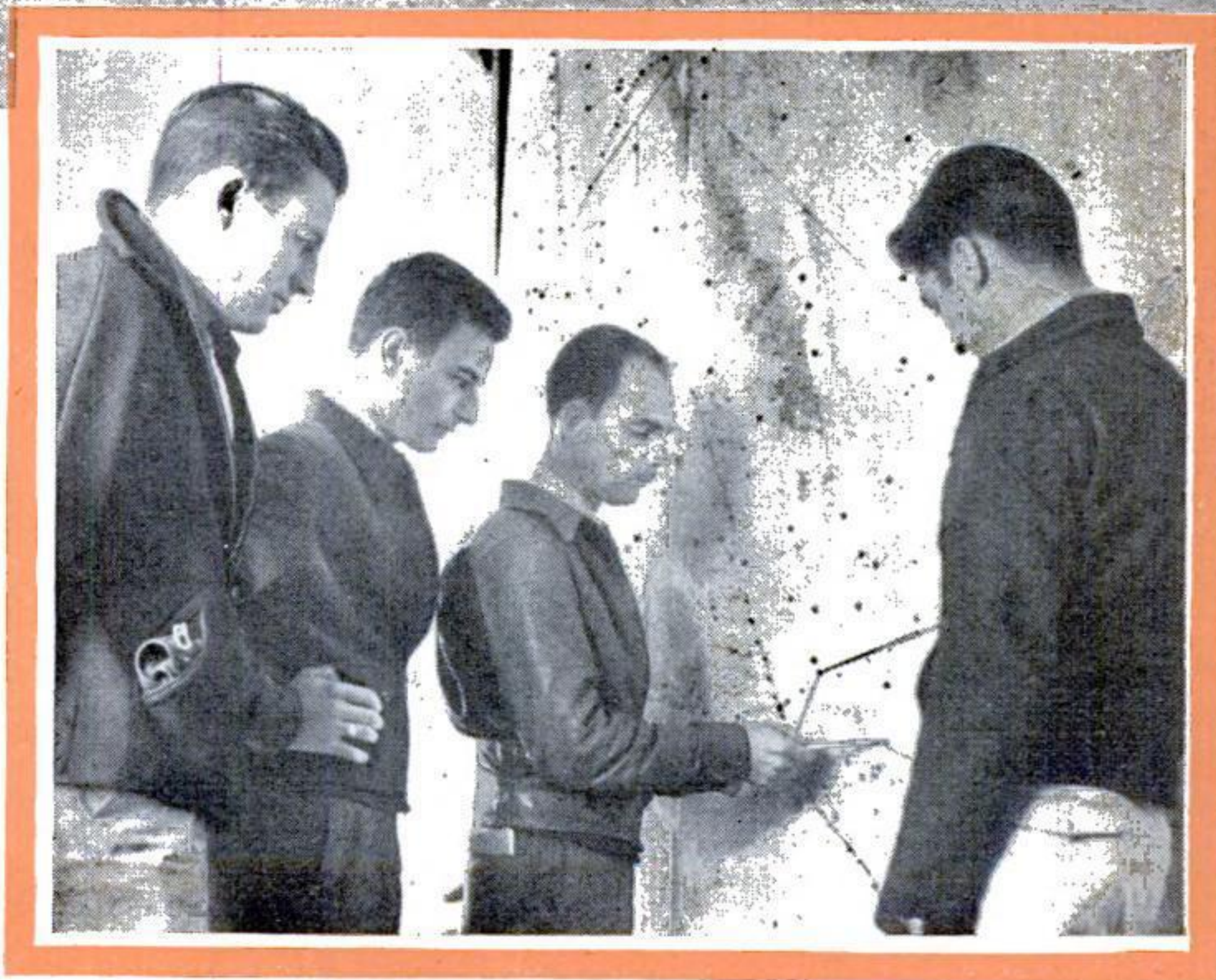
-from the Ground Up



Advanced students walking along the line-up of planes before the start of a cross-country flight

WITH Uncle Sam providing flying training for 300 young men from thirteen colleges as an initial step toward turning 20,000 college men into skilled flyers, American aviation schools are perfecting improved, scientific methods for training airmen. How fledglings are turned into crack pilots at one of the most modern air colleges in the country, the Ryan School of Aeronautics, San Diego, Calif., is illustrated on these pages.

The beginners learn to fly, literally, from the ground up. In the big shops at Lindbergh Field, they take apart and put together planes; assemble engines; practice sending and receiving radio messages; study navigation. For five hours daily, they engage in ground work. In addition, they spend as much as an hour a day in the air.

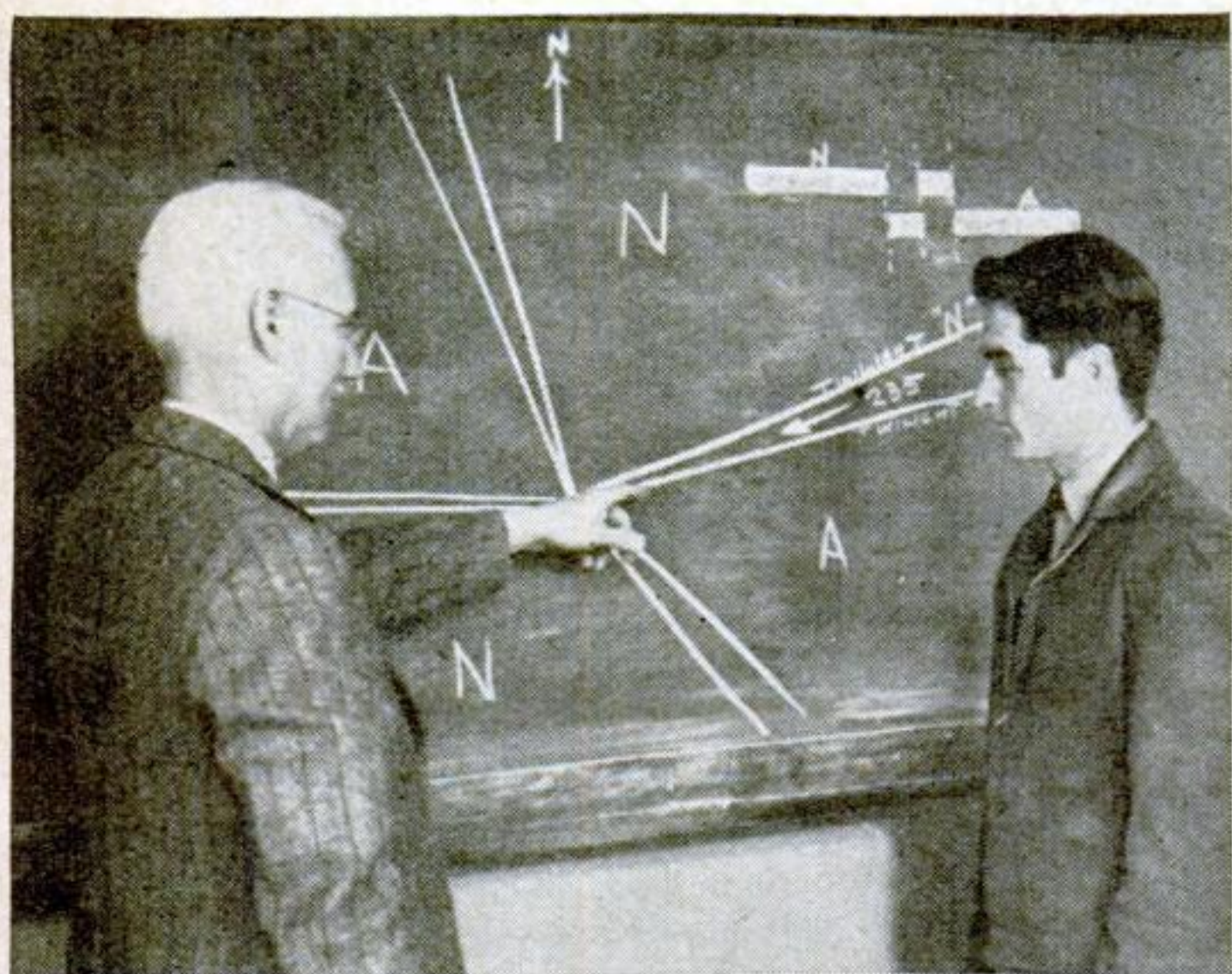


"Remember the beam and know your maps." These embryo pilots are getting orders in preparation for taking off on a hop to Boulder Dam

During the early training periods, the instructor takes off and lands, turning the controls over to the student after the ship has climbed to 2,000 feet. Holding the nose on the horizon, flying level, making wide, easy circles—these are mastered first. Steeper turns and vertical banks follow. Then come spins and landings, the most difficult part of



In the radio laboratory, the student practices sending and receiving messages as from the cockpit of a plane. Transport pilots take advanced radio work

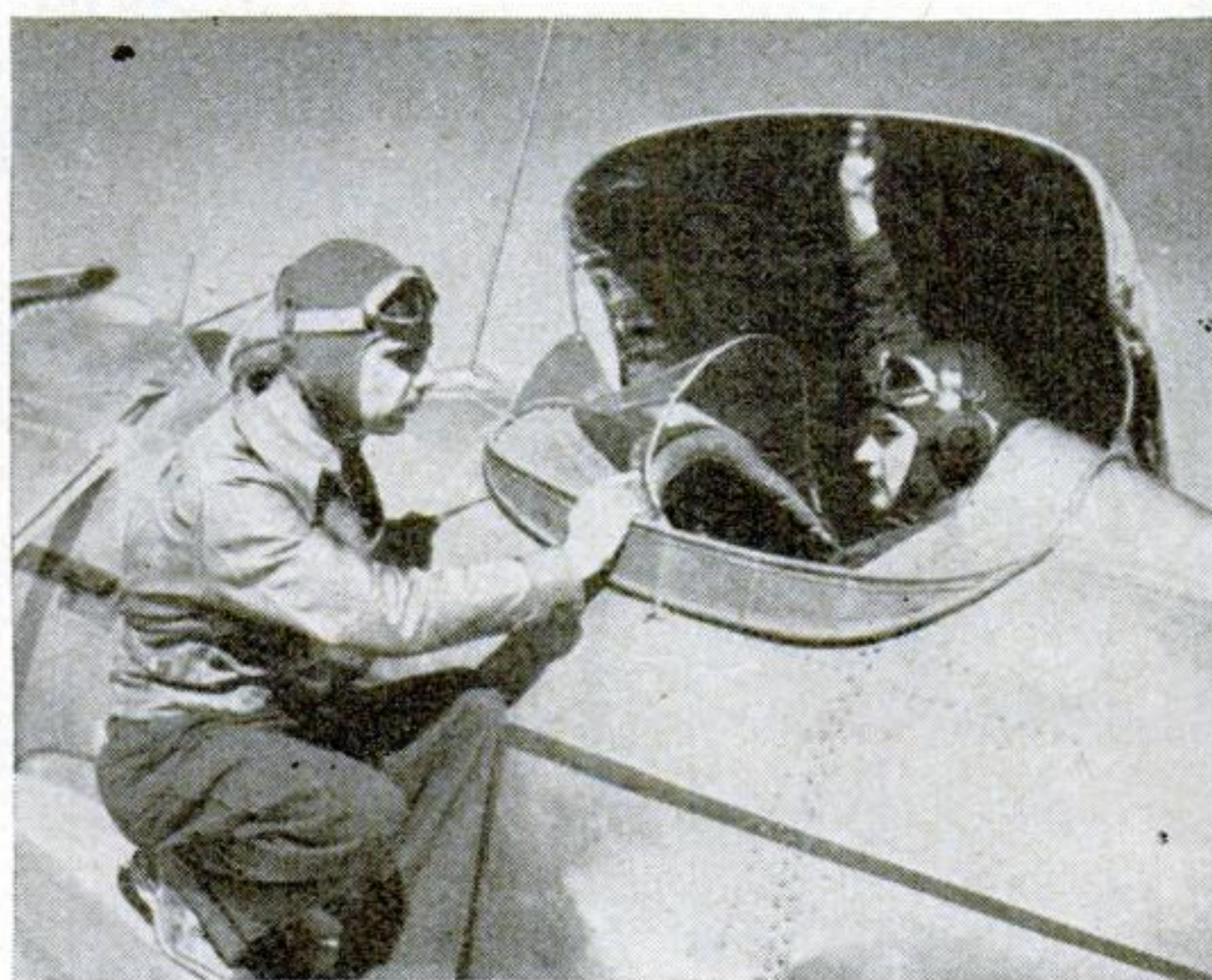


Mysteries of the radio beam are studied in black-board diagrams which make it easy for a beginner to visualize the beam pattern when in the air

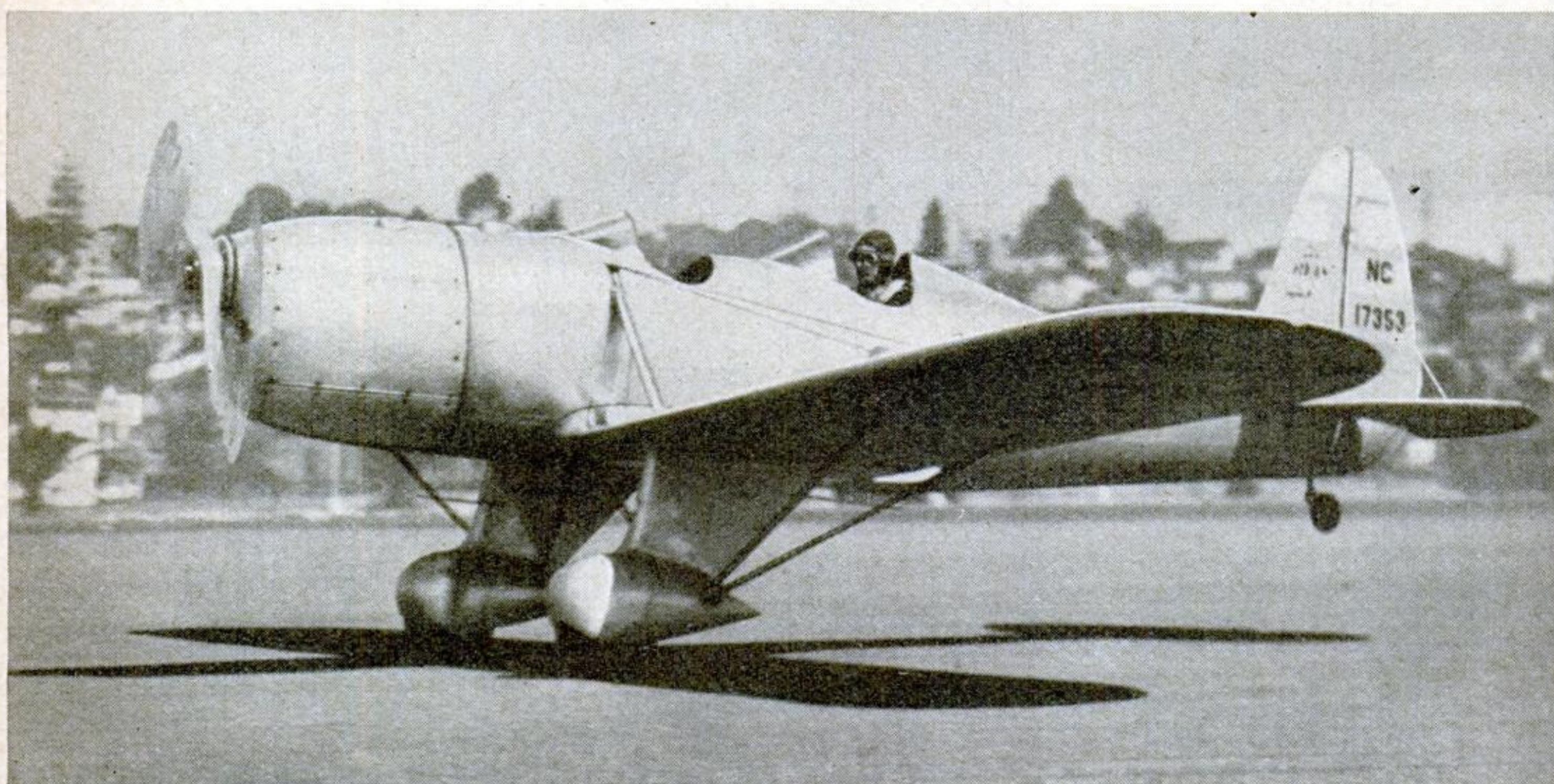
flying. After ten hours' training in the air, he is ready to make his first hop alone. His reward is a pair of "solo wings" pinned to his jacket.

By the time the student has been in the air fifty hours, he is ready for tests for his private pilot's license. From then on, he takes advanced work, dead-stick landings, power spins, night flying. He tries spot landings and comes in at night to land first by flood-light, then by the plane's landing lights.

With other students, he heads away from the field on cross-country flights. Finally, flying blind in a hooded cockpit, he guides his machine by instruments alone. The climax of his training comes about six months after he enrolls at the school. A Federal inspector puts him through the paces for the coveted commercial pilot's license. When he has won this, he is a fledgling no longer.



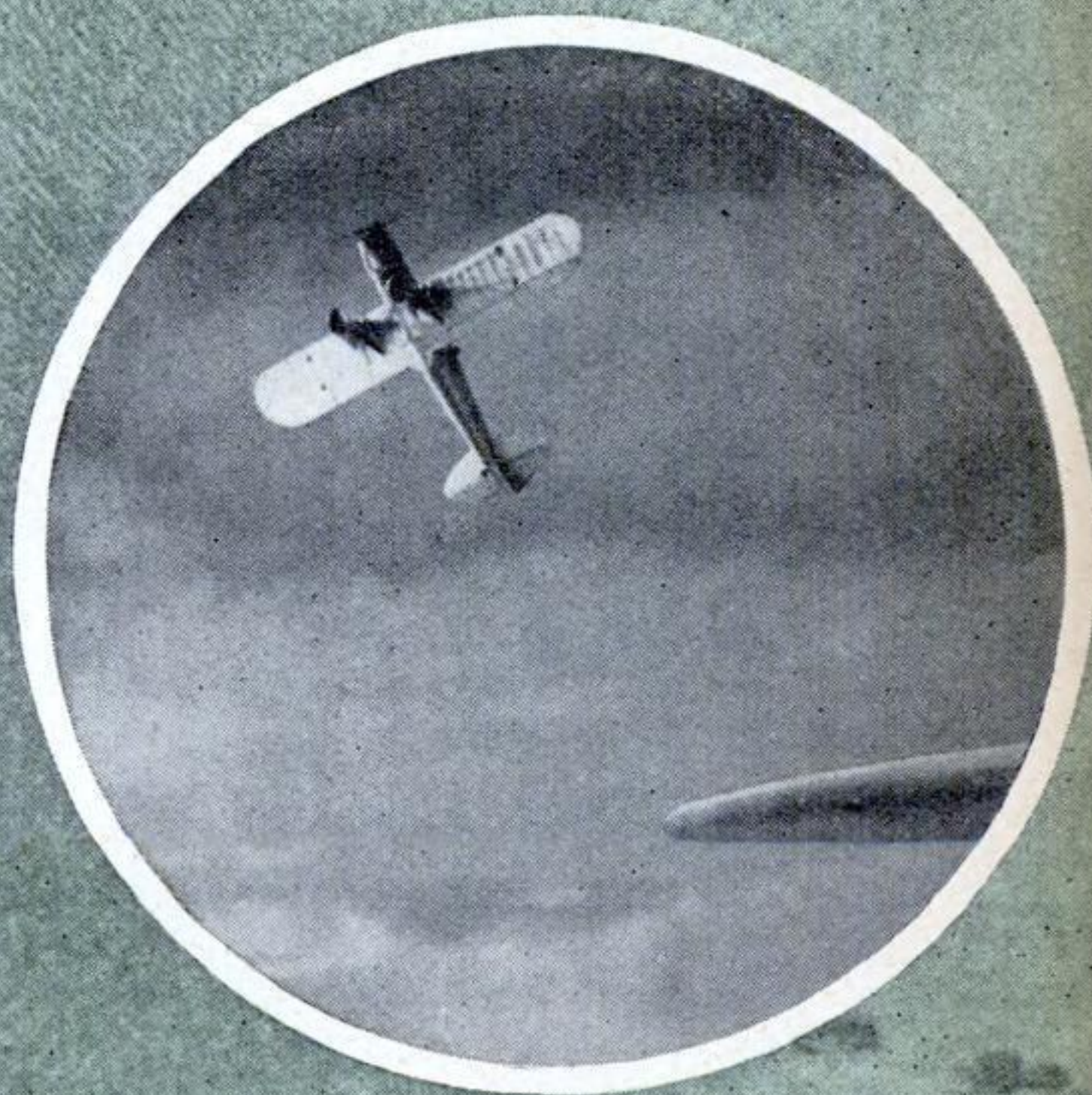
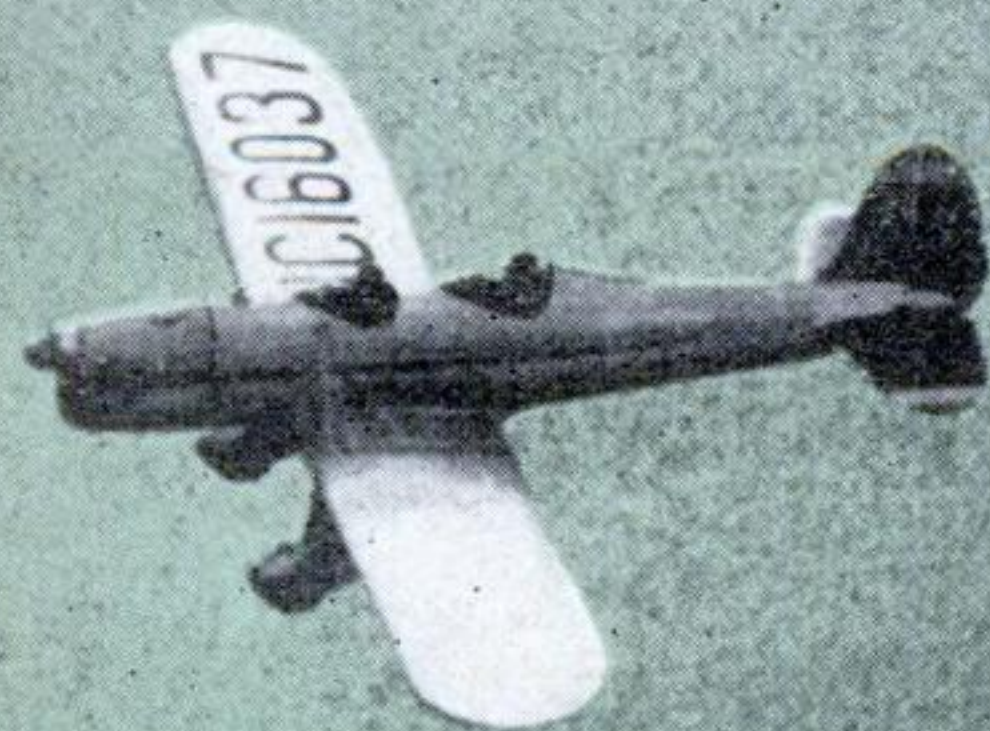
Ready for his ten hours of blind-flying training, the student goes "under the hood" for actual practice in following the beam along the airways

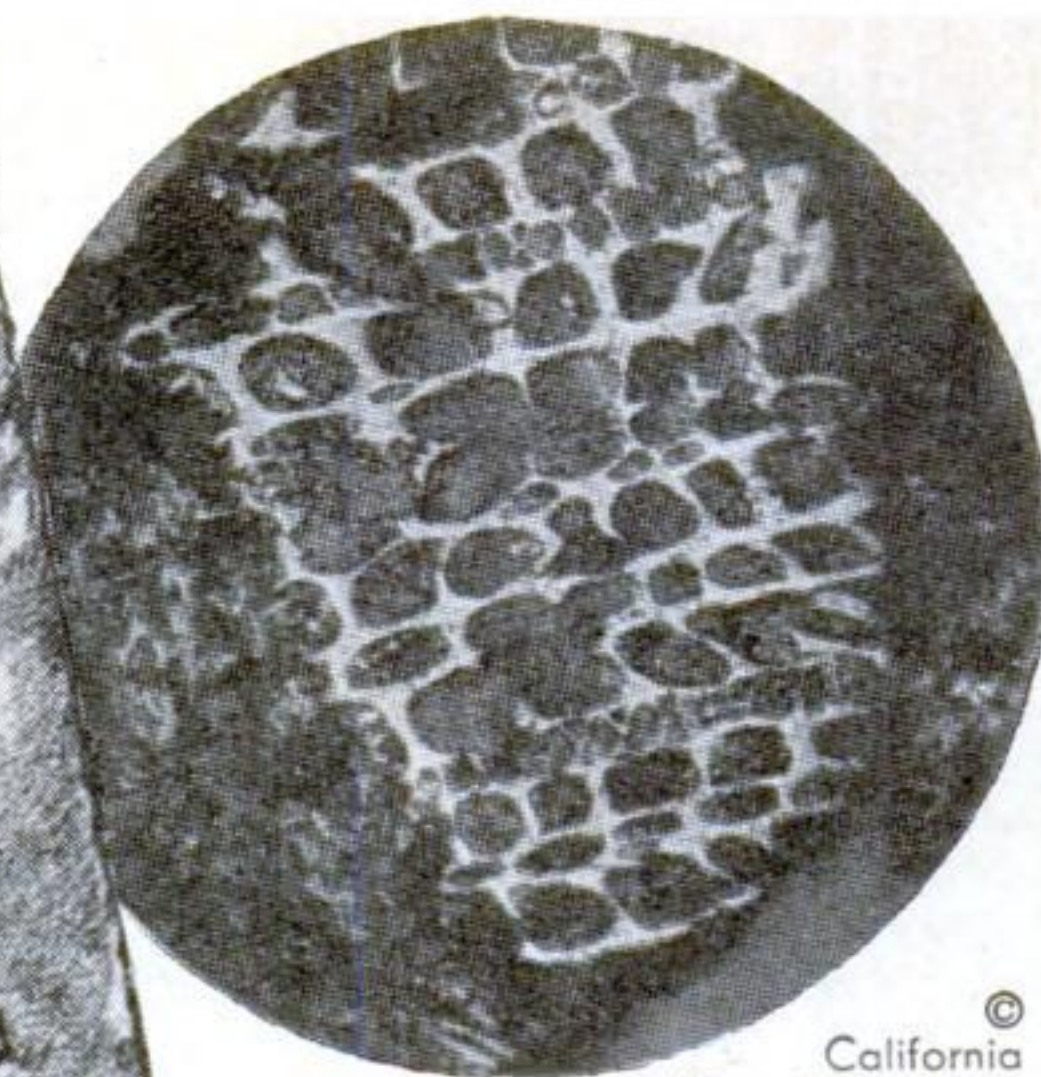
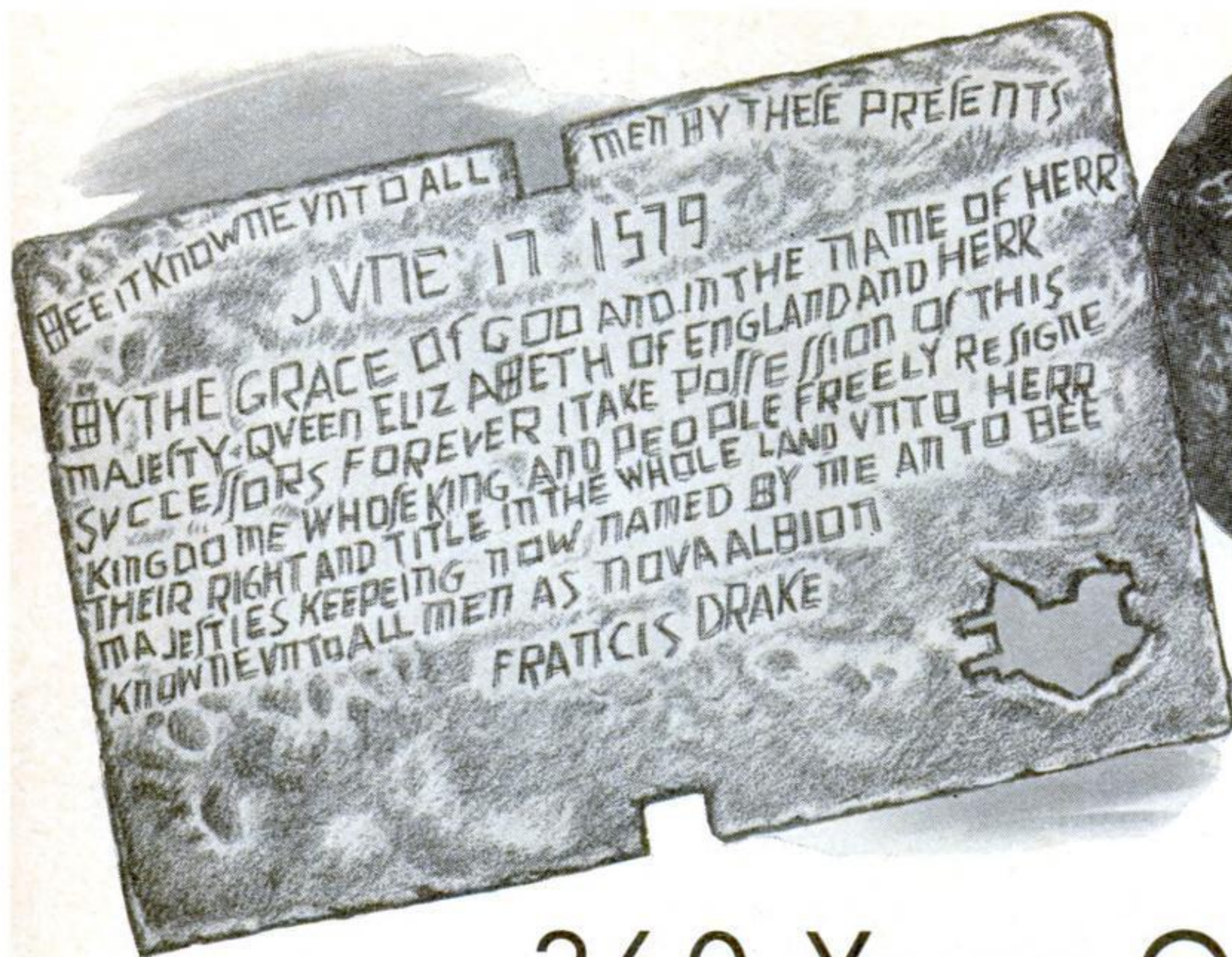


First solo. Perhaps the biggest thrill in any flyer's life is the first time he takes off alone in a plane

FLYING IN FORMATION

A quintet of training ships in the air over San Diego Bay. On cross-country flights, when the air is smooth, students try formations like this. Some of the long-distance jaunts take fledgling flyers as far as 400 miles from the home base, with as many as five planes taking part. The embryo pilot is due for more thrills when he first tries his hand at acrobatics—loops, wing-overs, spins, and Immelmans. In the circle, a plane is seen making a loop





© California Historical Society

Left, brass plate set up in California by Sir Francis Drake in 1579. Above, mineralized plant cells found on plate by the microscope

360-Year-Old Relic

VERIFIED BY THE MICROSCOPE

THREE years ago, while picnicking on a ridge overlooking San Francisco Bay, Beryl Shinn, Oakland, Calif., department-store clerk, found a curious brass plate. Today, as a result of his discovery, Shinn is \$3,500 richer and the California Historical

Society possesses the famed plate of brass which Sir Francis Drake, sixteenth-century English naval hero, left there in 1579 to establish claim to the region in the name of Queen Elizabeth of England. Until recently, historical experts have been arguing hotly,

one group claiming that the find was genuine, and the other maintaining that it was a hoax. To settle the controversy, the plate was subjected to elaborate tests by a committee of scientists headed by Prof. Colin G. Fink, Columbia University electrochemist. Microscopes, spectroscopes, and all the facilities of the modern chemical laboratory were turned loose on the mysterious brass relic to check its workmanship and other factors that might establish its age and authenticity. Chemical tests have shown that the dark surface coating is a natural patina formed by aging. Bits of mineralized plant tissue were detected, another sign of age. Impurities not present in modern brass, and the fact that it was hammered and not rolled into shape, were further corroborating facts.



Beryl Shinn, finder of the historic plate, with the girl he married after receiving \$3,500 as a reward for his important discovery

Trailer Chapel Has Speaker System

BUILT into a trailer, a chapel on wheels brings church services to isolated mountain sections of Virginia and West Virginia. Its rear wall unfolds to form a platform before the altar, and a canopy containing two loudspeakers for a public-address system, which carries the preacher's voice to the congregation. A gasoline-driven generator mounted in the back of the sedan that draws the trailer supplies electric power for the public-address system and for cooking and lighting. Supplemented by a storage battery, the generator unit automatically starts when a light or appliance is turned on, and stops when all are switched off.



Trailer chapel in use. Loudspeakers are housed in the canopy above the folding platform



Water churned up by the motor massages the feet

Water Massages the Feet in Motor-Powered Tub

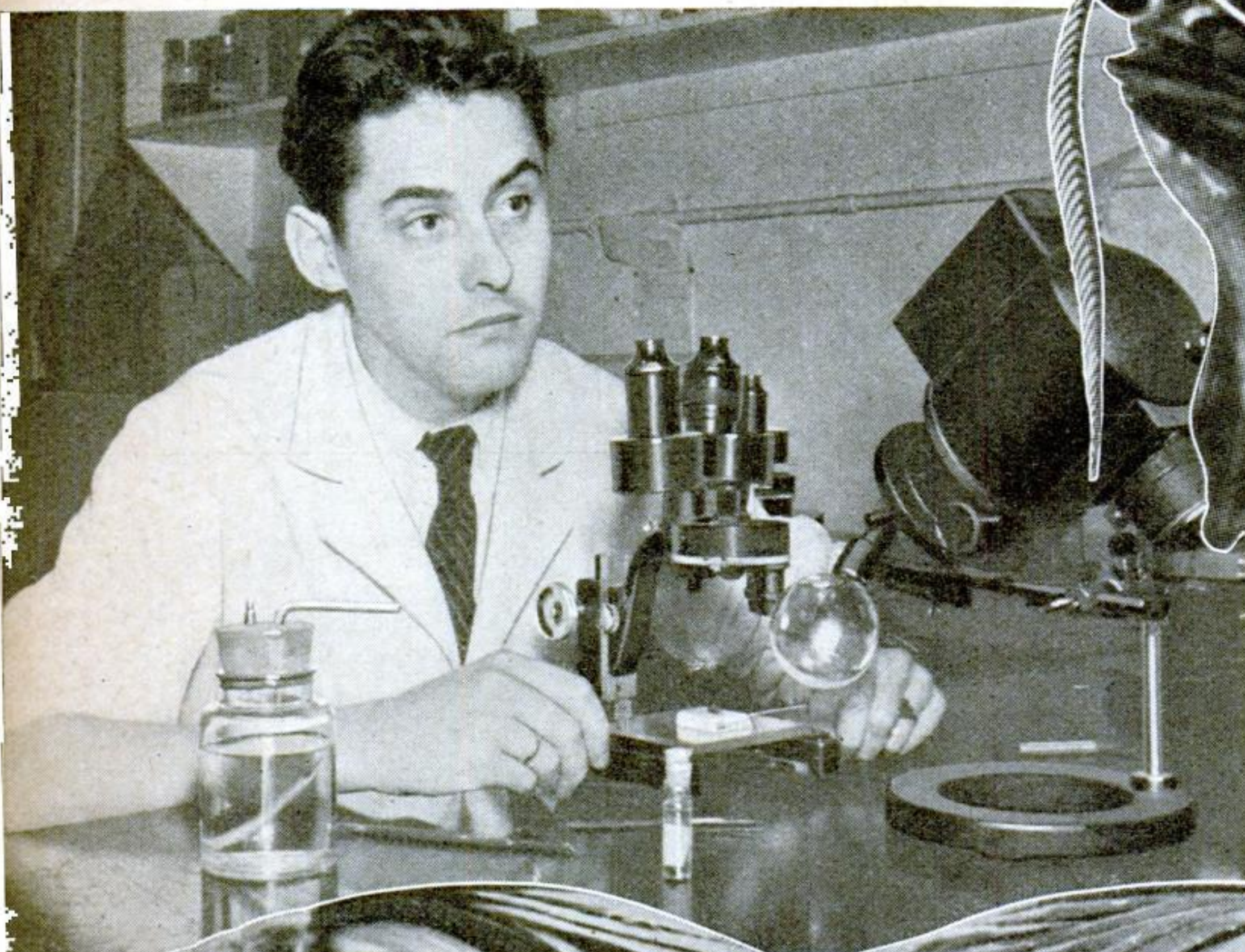
WATER swirling about the legs, in a new motor-powered bath for treating foot ailments, is declared to give the equivalent of a half-hour hand massage in only ten minutes. The novel apparatus is being demonstrated in the photograph shown at the left, as the patient undergoing the treatment relaxes in a comfortable chair. According to the maker, the user of the health aid experiences the sensation of wading in a babbling brook.

Planes Wait Turns To Land

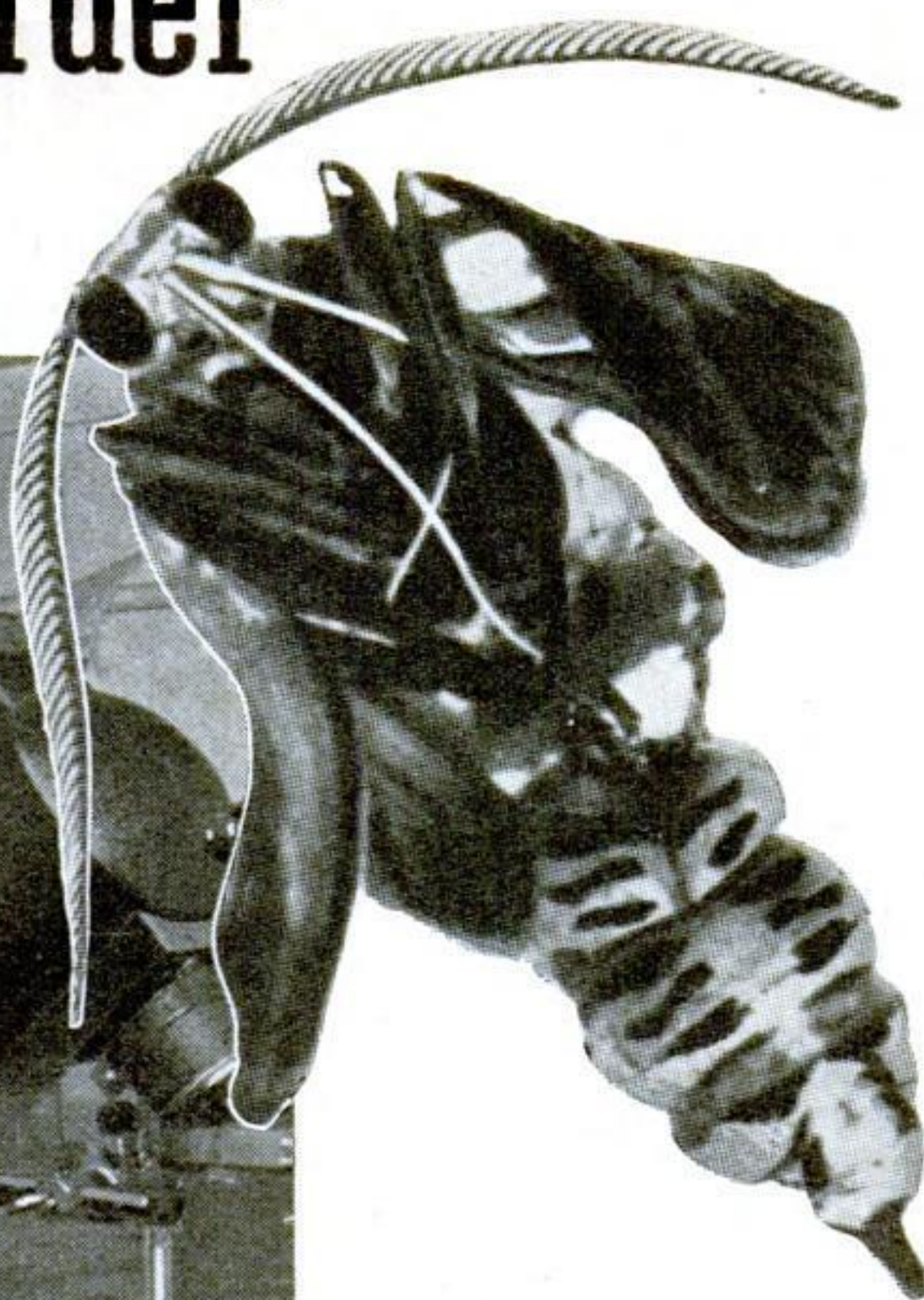
"STACKING" is the picturesque name given by airport men to the procedure of handling planes that arrive simultaneously at the field in bad weather. Radioed instructions order the planes to remain at altitudes 1,000 feet apart until given permission to land. Then the circling craft are brought down safely, one at a time.

Queer Bugs Made to Order

BY INSECT MIRACLE MAN



Dietrich Bodenstein in his laboratory. Above, a strange creation, part oak moth and part chrysalis

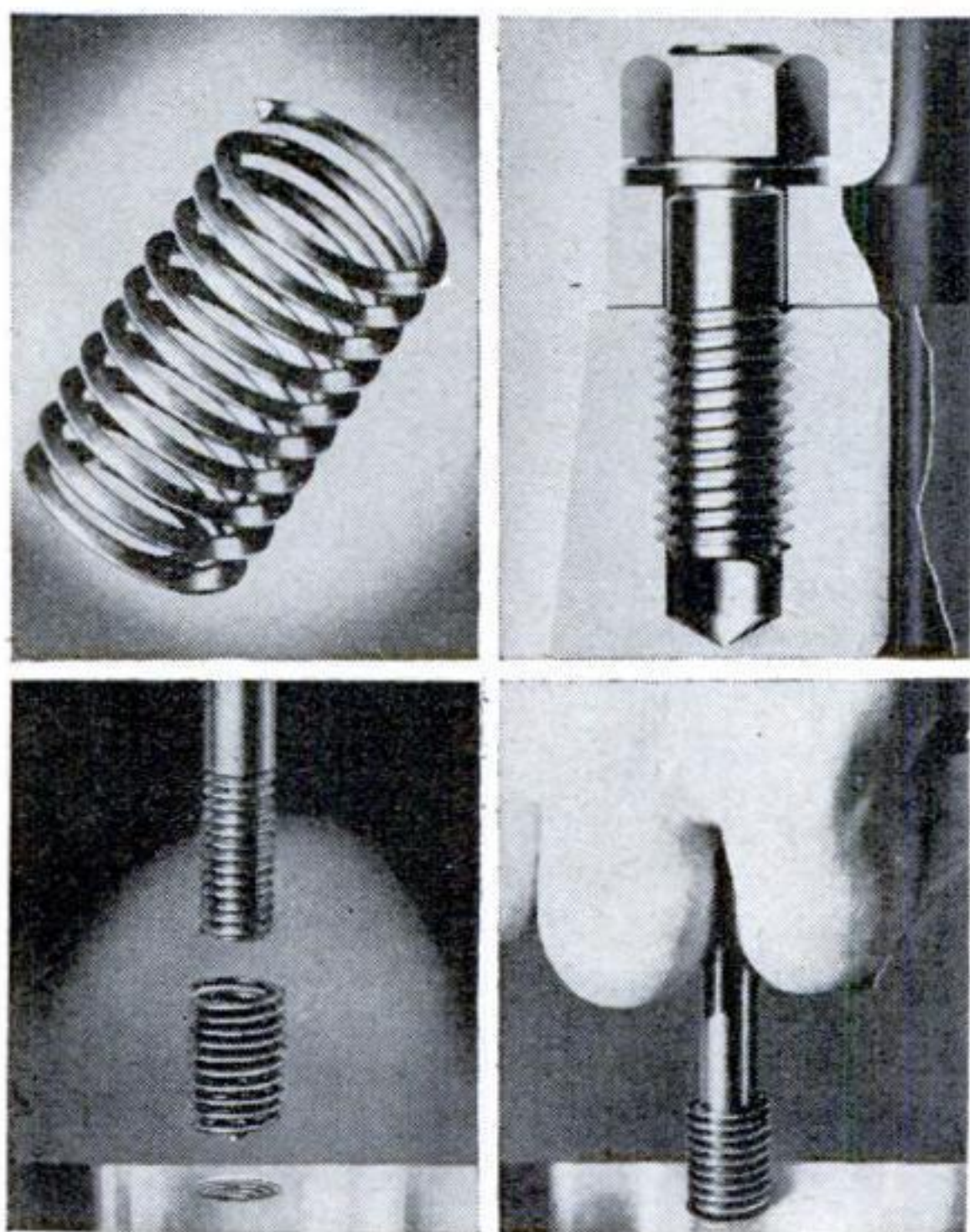


Removing a caterpillar leg for grafting onto a butterfly. Upper picture shows "Siamese-twin" oak moths, two chrysalises joined and now growing head to head

NEVER before, unless in nightmares, have scientists set eyes on some of the living, crawling, and fluttering insects that are found in the laboratory of Dietrich Bodenstein at Stanford University. Artificially created, they include caterpillars with butterfly wings, "Siamese-twin" moths, and strange creatures that are half moth and half chrysalis. Probing the mystery of how caterpillars turn into butterflies and moths, the young miracle worker discovered a chemical that acts like a hormone in the head of the larva. He cut a caterpillar's circulation just behind this point, and it promptly sprouted the wings of a butterfly. When he grafted a caterpillar leg to a butterfly, it skipped six normal molts and became a butterfly leg in a single molt. A ligature of fine silk around the chrysalis, or pupa, of an oak moth allowed the fore parts to develop into a moth, while the abdomen remained in the chrysalis stage. Again, two oak moths joined head to head with wax grew together.

Bolts Strengthened by Thread Inserts

GREATLY increased strength is claimed for threaded bolts and studs inserted in tapped machine holes by a novel system just introduced. A special metal spring is inserted in the tapped hole, and an undersized stud screwed into this insert, which is said to furnish protection to the threads and provide a smooth, hard bearing surface.



These pictures show how a special metal spring is inserted in the tapped hole and the threaded bolt or stud screwed into it



Typewriter Works Automatically

TO SPEED UP routine office correspondence, such as form letters, reminders of overdue accounts, and similar business forms, an automatic typewriter recently placed on the market types prepared paragraphs of text on letterhead stationery, making it necessary for a stenographer only to fill in the salutation, address, and additional dictated material meant for a specific addressee. Electrically operated, the machine has a control dial with which any one of several prepared texts may be selected at will for automatic typing on stationery inserted in the machine.

Treadmill Propels Child's Wagon



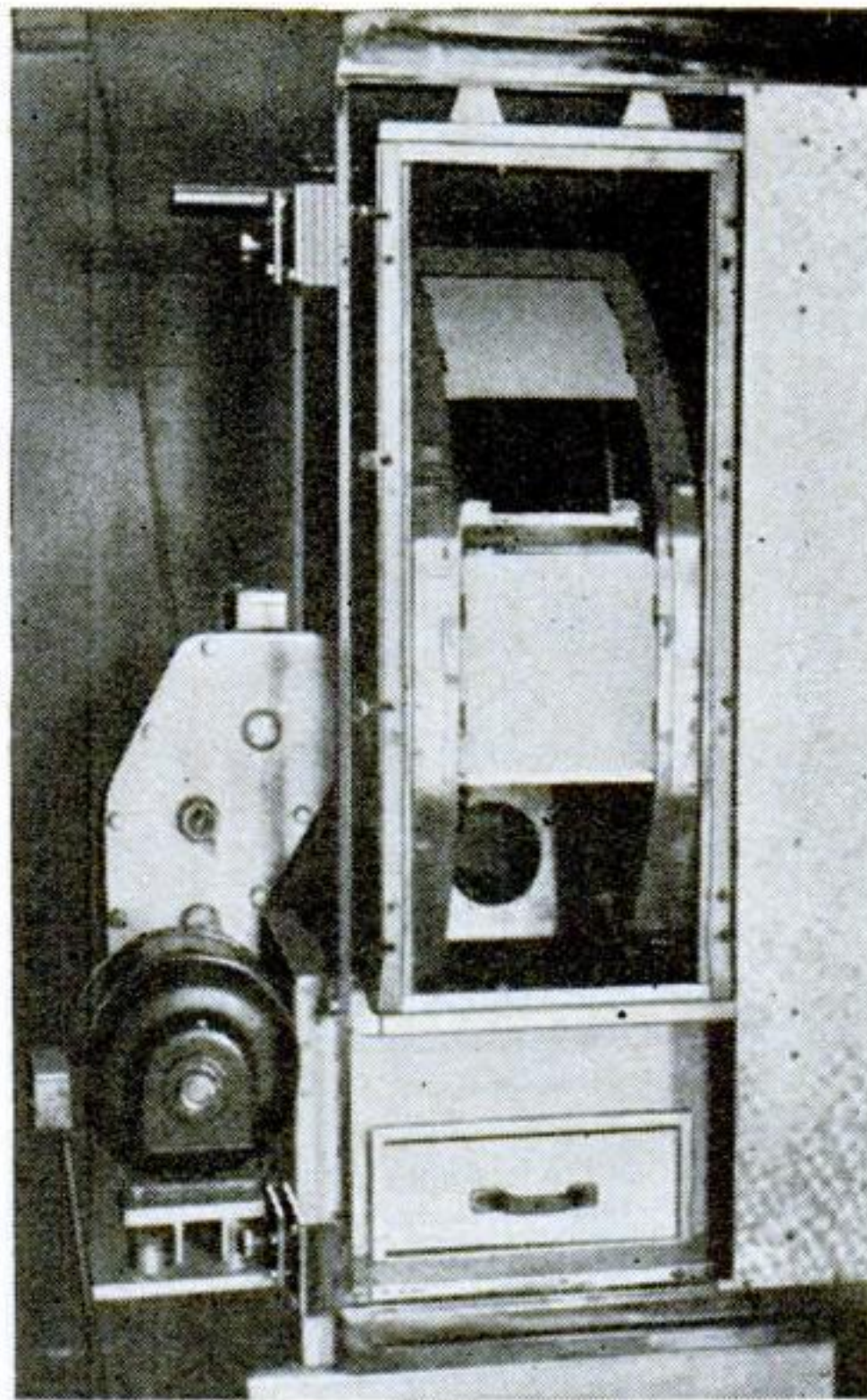
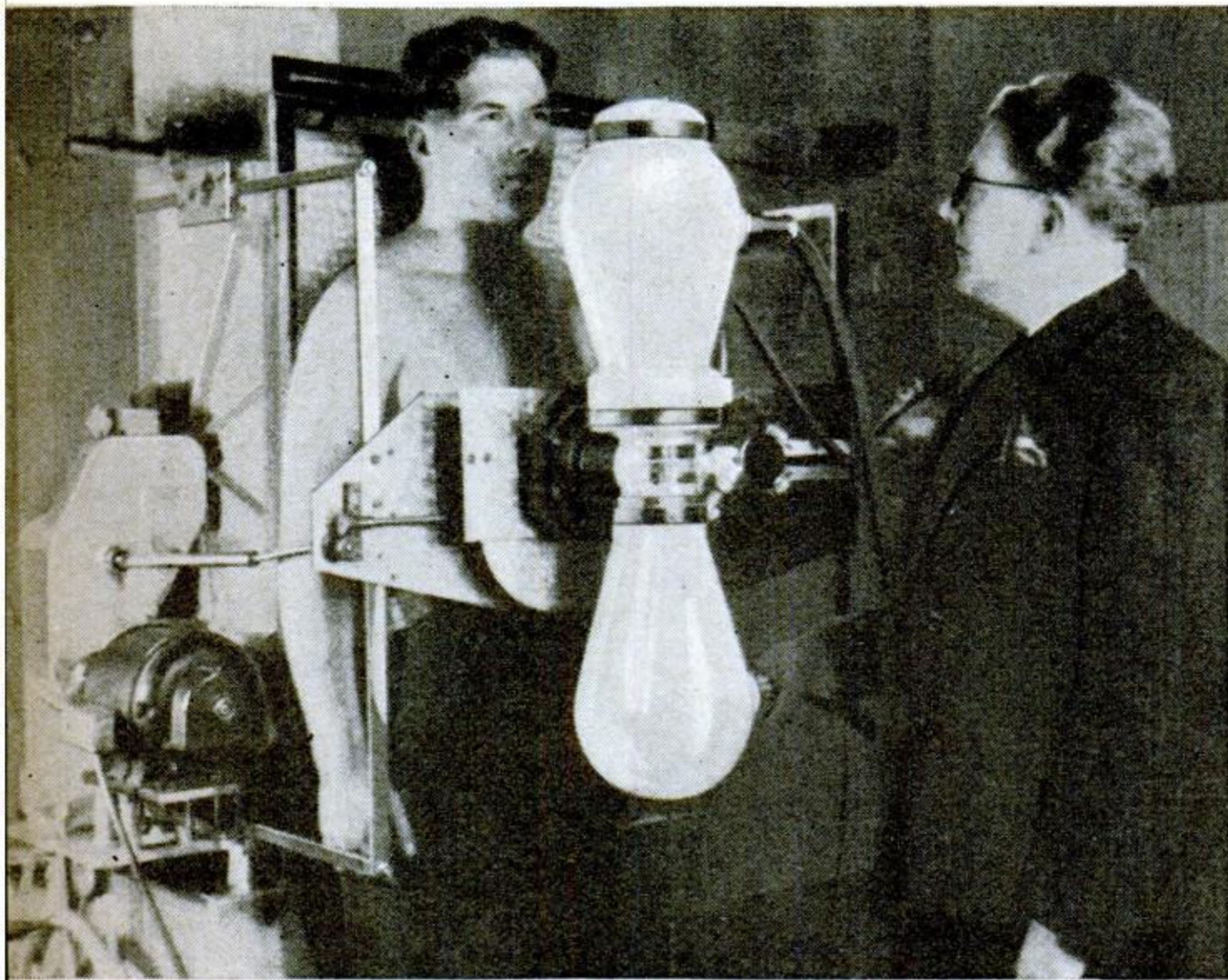
A folding floor board covers the rollers to allow ordinary use of wagon

WALKING on rollers that are geared to the rear wheels of a novel treadmill wagon, a child can propel the odd vehicle along the ground. Invented by Harry Kister, of Philadelphia, Pa., the cart is fitted with removable floor boards that cover the rollers, so that it may be used as a conventional express wagon for transporting small articles. When the wagon is turned upside down, the rollers are exposed, permitting the device to be used as a stationary exercising machine, which is strong enough for regular use by adults as well as by children.



By walking on the rollers, a child can propel the vehicle

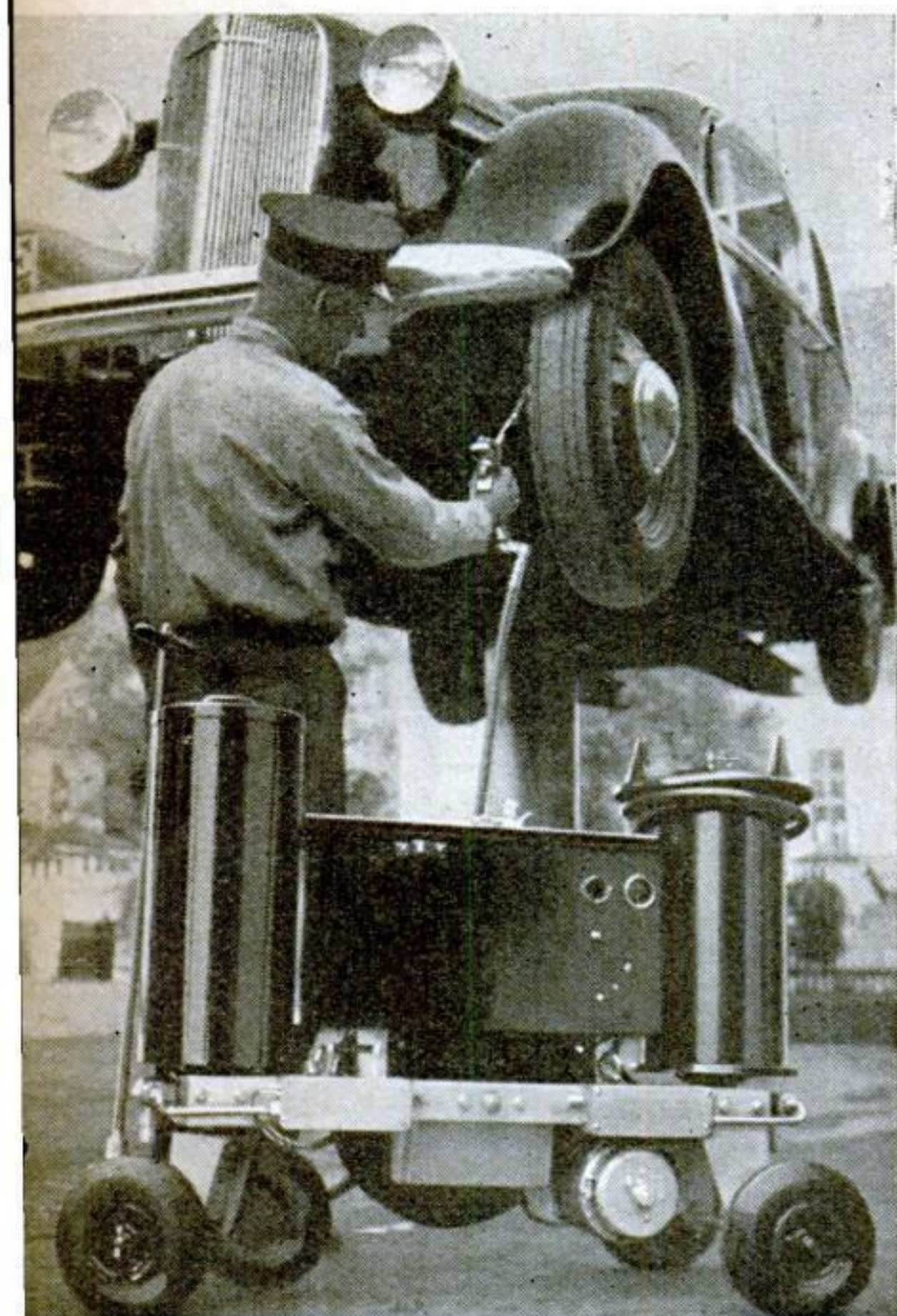
New "Camera" Makes X-Ray Movies



taking X-ray movies of a patient. Right, view of film-carrying mechanism showing plates on revolving drum

MOTION pictures made with a rapid-fire X-ray "camera" devised by a Belgian radiologist will help physicians to study and to diagnose the ailments of moving body organs. Instead of making single shots, the machine exposes a series of large X-ray films in quick succession. This is done by mounting the specially slotted films upon a motor-

driven revolving drum, seen within the machine in the right-hand view above. For examination, the resulting sheaf of pictures may then be transferred to motion-picture film and run off in a projector at any desired speed, so that the movements of the internal organs, as they appear on the film, are vividly shown on a conventional screen.

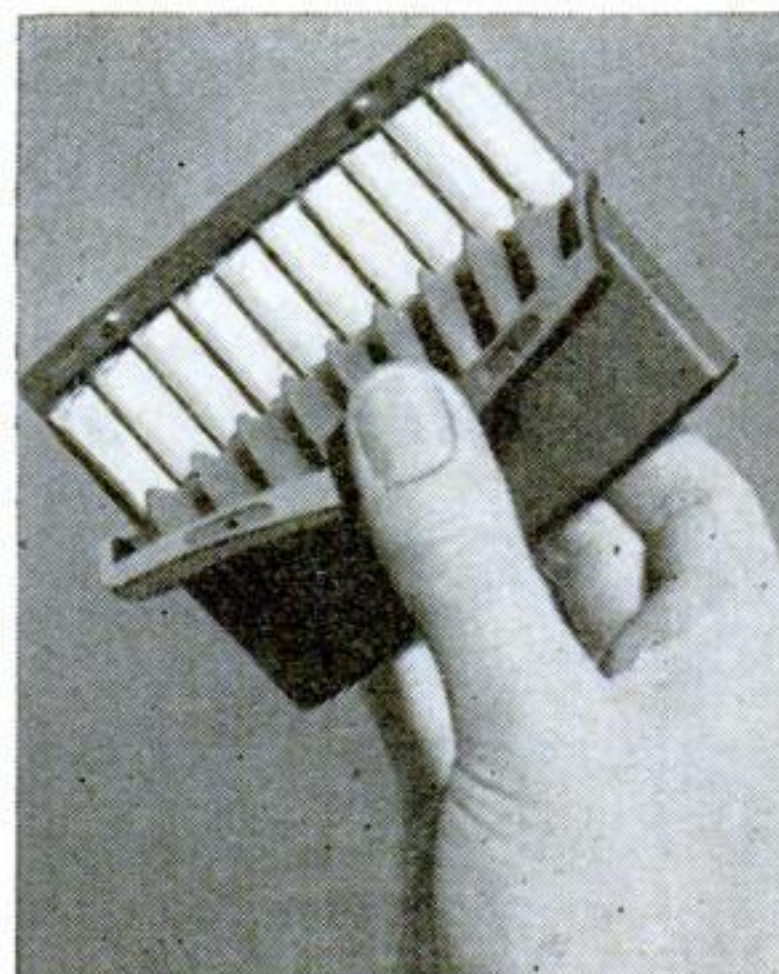


Car Greaser Is Portable

DISPENSING with trailing wires or air hoses, a new electric grease gun on wheels delivers lubricant just where it is wanted, at pressures up to 12,000 pounds. A heavy-duty storage battery that supplies current for the motor-driven pump, and a built-in charger for the battery, make the pneumatic-tired "lubrication scooter" self-contained.

Rubber Case for Cigarettes

COMFORTABLE to carry, a new cigarette case of rubber is declared sufficiently flexible to conform to the body, but stiff enough to protect from damage the ten cigarettes it holds. To remove one, the elastic cover flap is drawn back as shown at right. When released, it closes of its own accord.



he grease gun's air pump is battery-powered

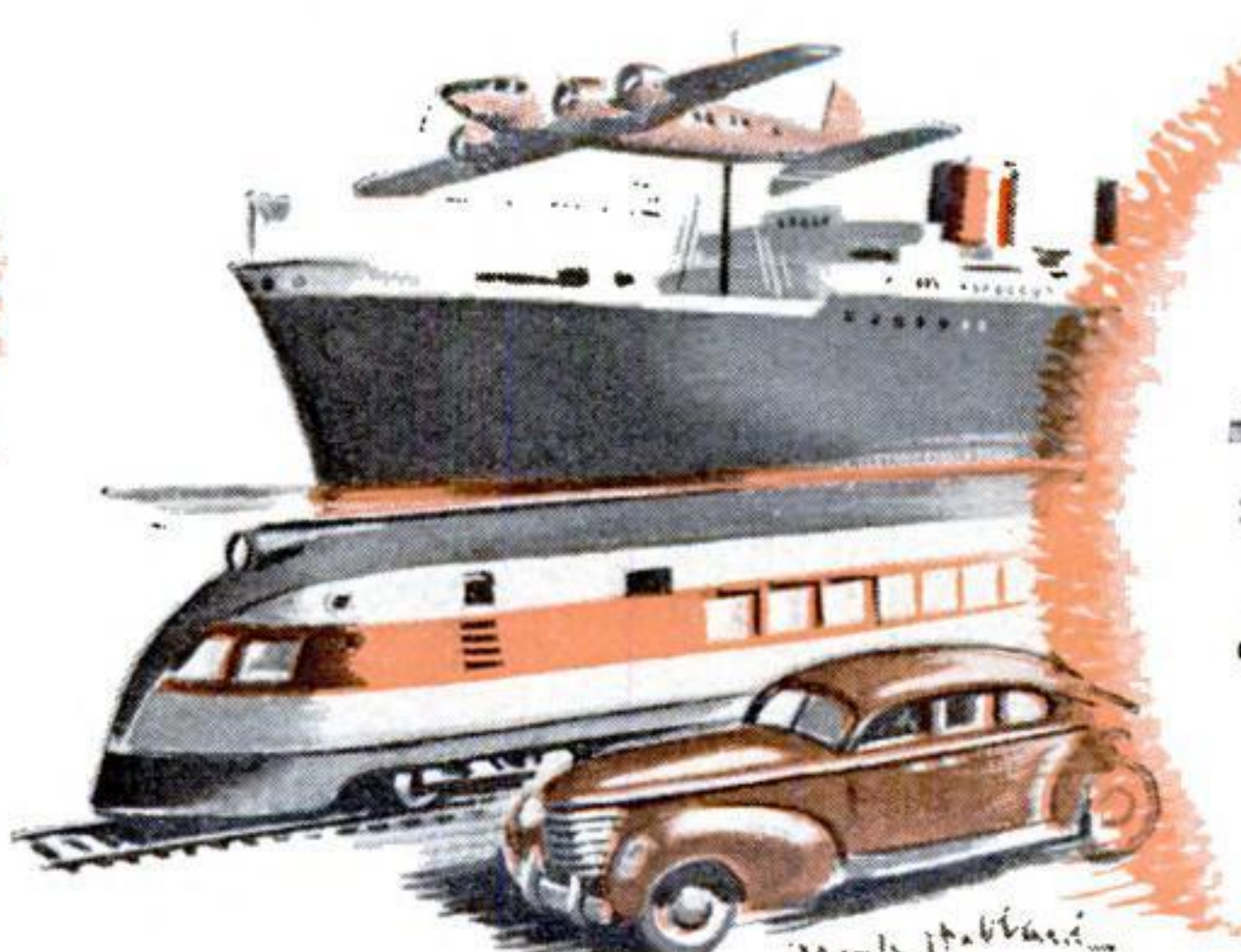
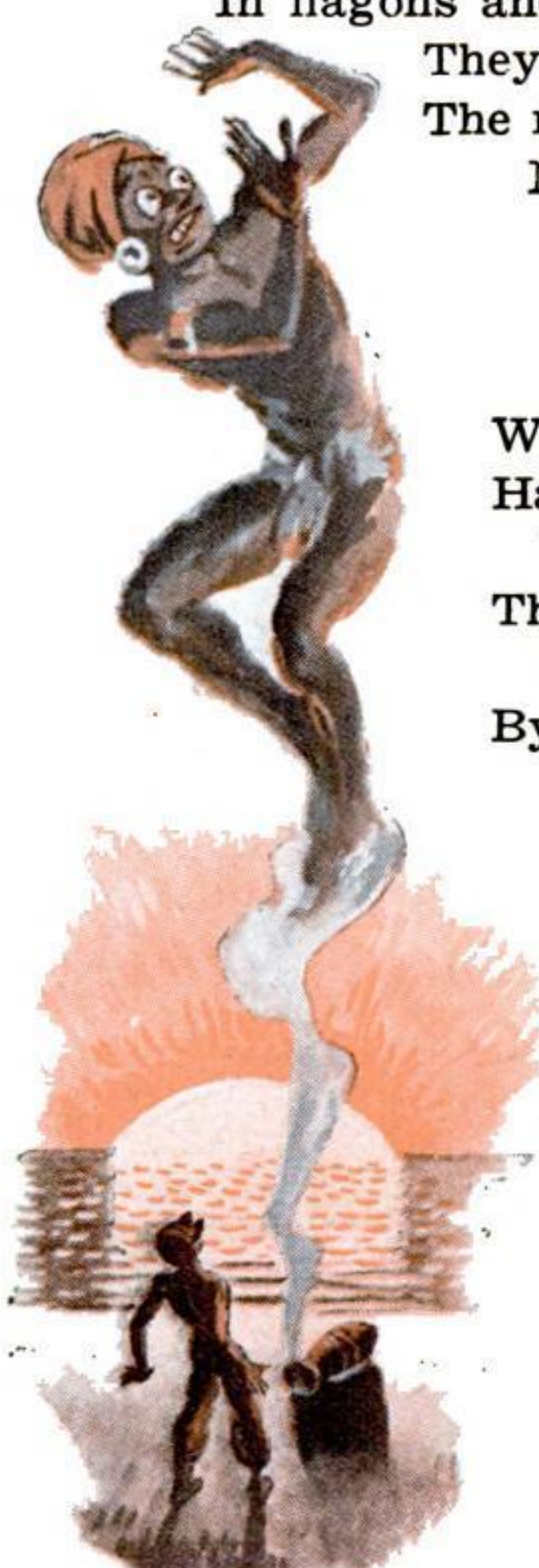
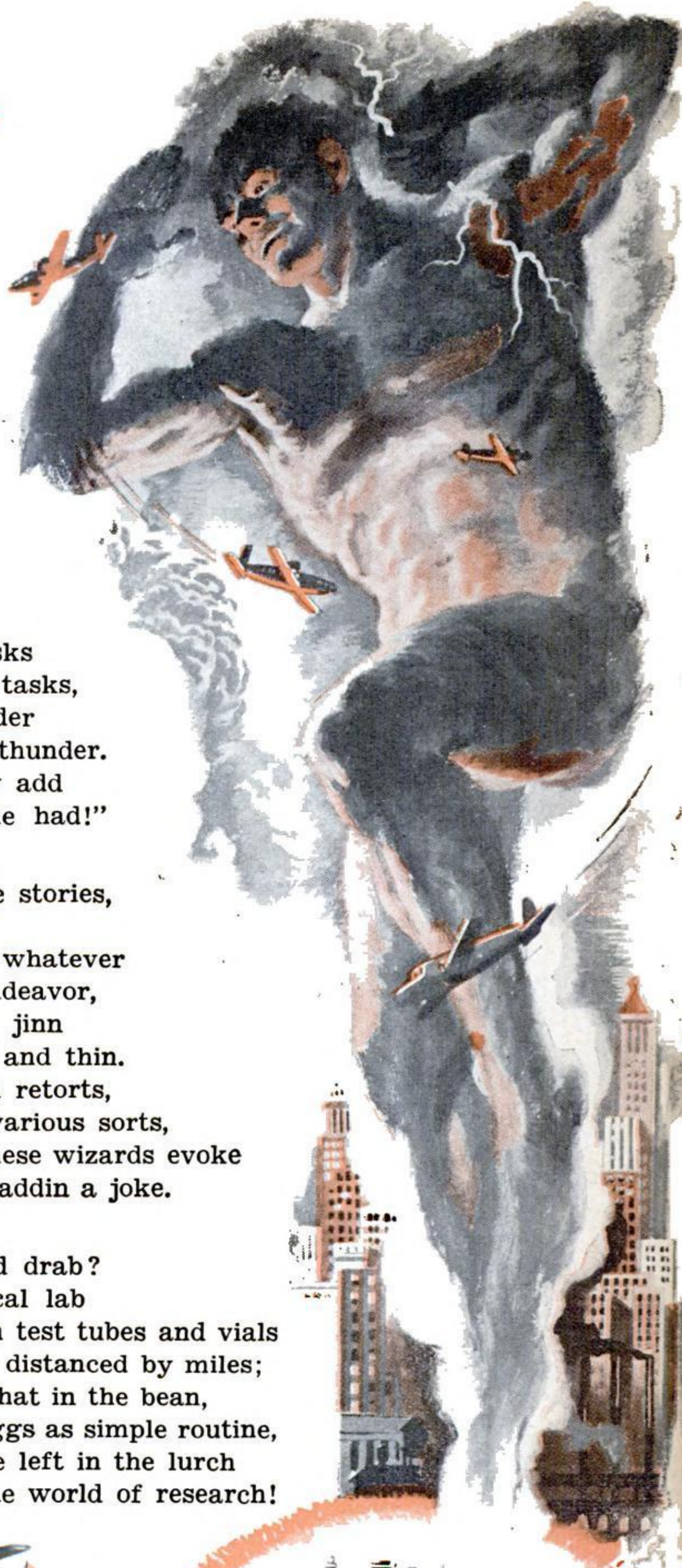
Talk About Fairy Tales

By
BERTON BRALEY

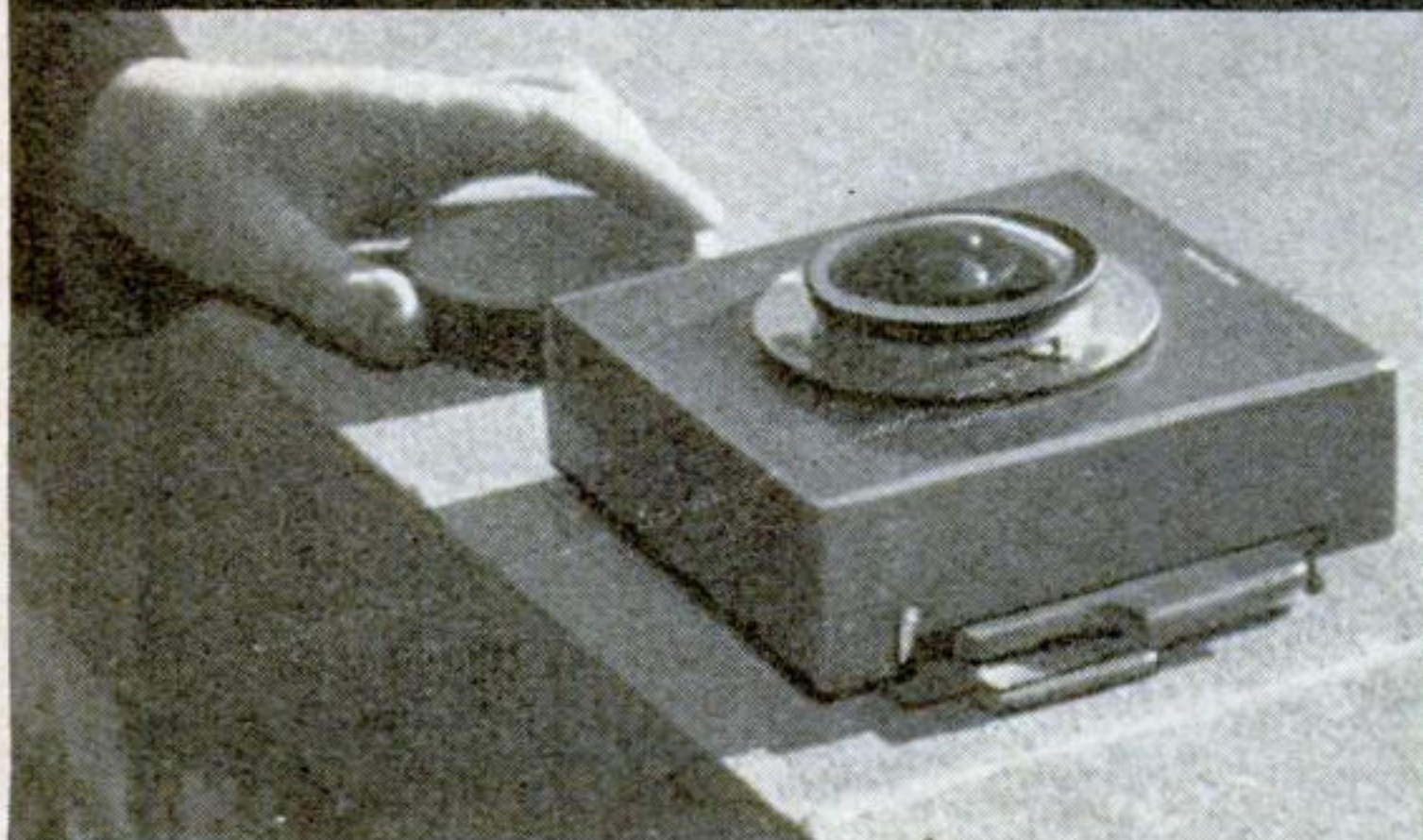
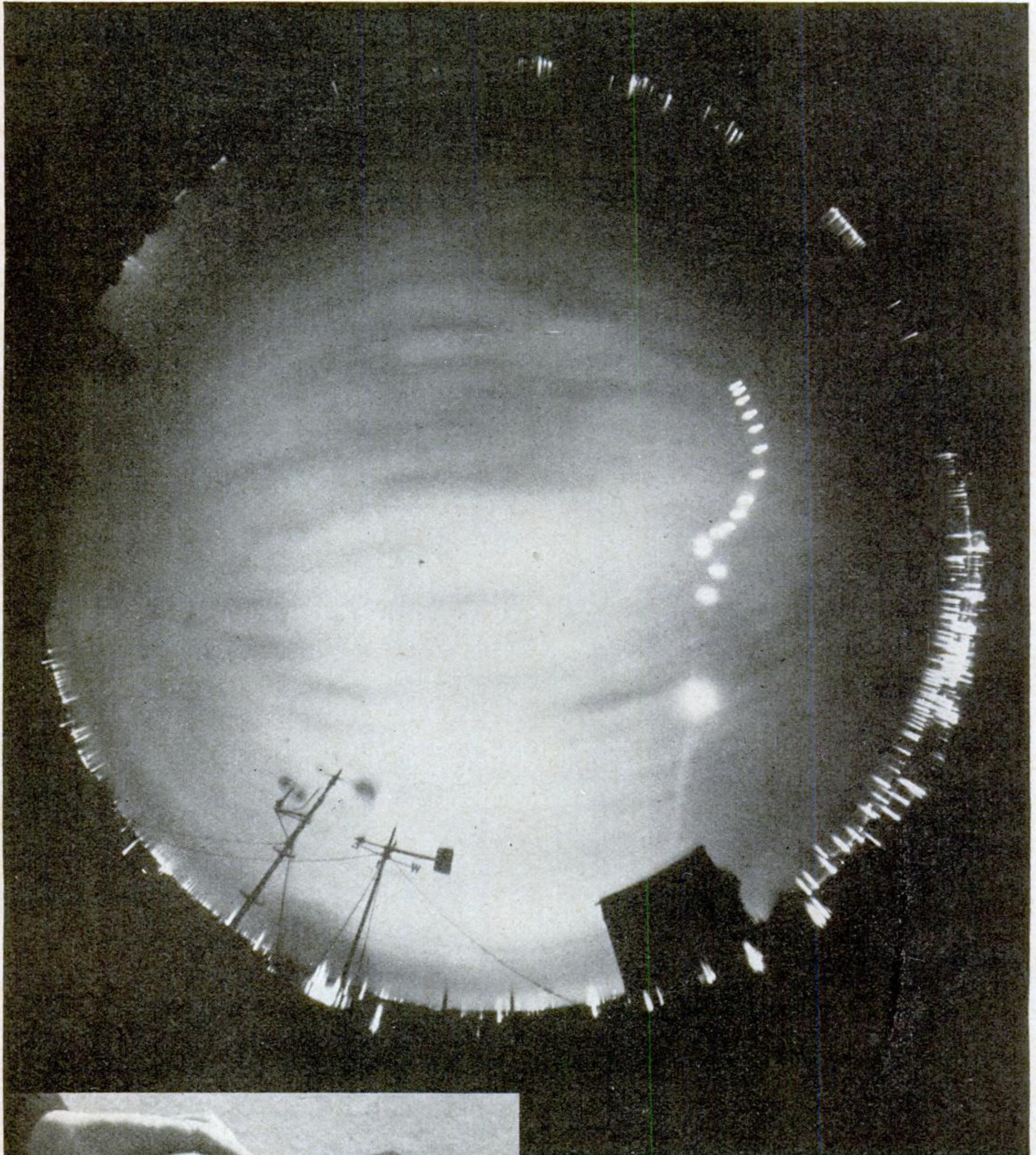
In Burton's "Arabian Nights"
We're told about spirits and sprites
And powerful jinn hid in lamps and in flasks
Who pulled off all manner of marvelous tasks,
Accomplishing many a seven days' wonder
Accompanied always by lightning and thunder.
We sniff at these legends and airily add
"What fanciful fancies Scheherazade had!"

And yet, while we snort at the stories,
The chemists in laboratories
Without any thunder or lightning whatever
But merely pursuing their daily endeavor,
Are busily bottling up powerful jinn
Beside whom the old ones seem feeble and thin.
In flasks and test tubes, in flasks and retorts,
They prison enchantments of various sorts,
The might of the jinn whom these wizards evoke
Makes Sindbad a piker, Aladdin a joke.

Today's unromantic and drab?
Look into the chemical lab
Where jinn they engender in test tubes and vials
Have those of Scheherazade distanced by miles;
Without any magic save that in the bean,
They're hatching out roc's eggs as simple routine,
Scheherazade's fancies are left in the lurch
By commonplace facts in the world of research!



Training Weather Men



Flares ignited at intervals trace the course of a pilot balloon sent up at night to determine the direction and velocity of winds at different levels. The photographic record is made on the plate of the 180-degree camera pictured at the left

By
KENNETH M. SWEZEY

TO TRAIN skilled weather observers and forecasters for air-transport lines, municipalities, the U. S. Weather Bureau, and dozens of industries where a foreknowledge of weather conditions might be the means of saving lives and money, is the unusual job cut out for the department of meteorology recently organized by the School of Engineering of New York University, in New York City.

Here, in a completely equipped weather station, coöperating with the Weather Bureau in Washington, and connected by radio and teletype with the weather service maintained by the air lines of the whole country, students make constant checks of temperature, sunshine, rain, barometric pressure, and wind velocity. In specially designed classrooms they make charts and computations, and learn to correlate these data with the latest meteorological theory. To put this learning to practical test, a forecast for the coming twenty-nine hours is completed at 12:30 p.m. each day and distributed in a bul-



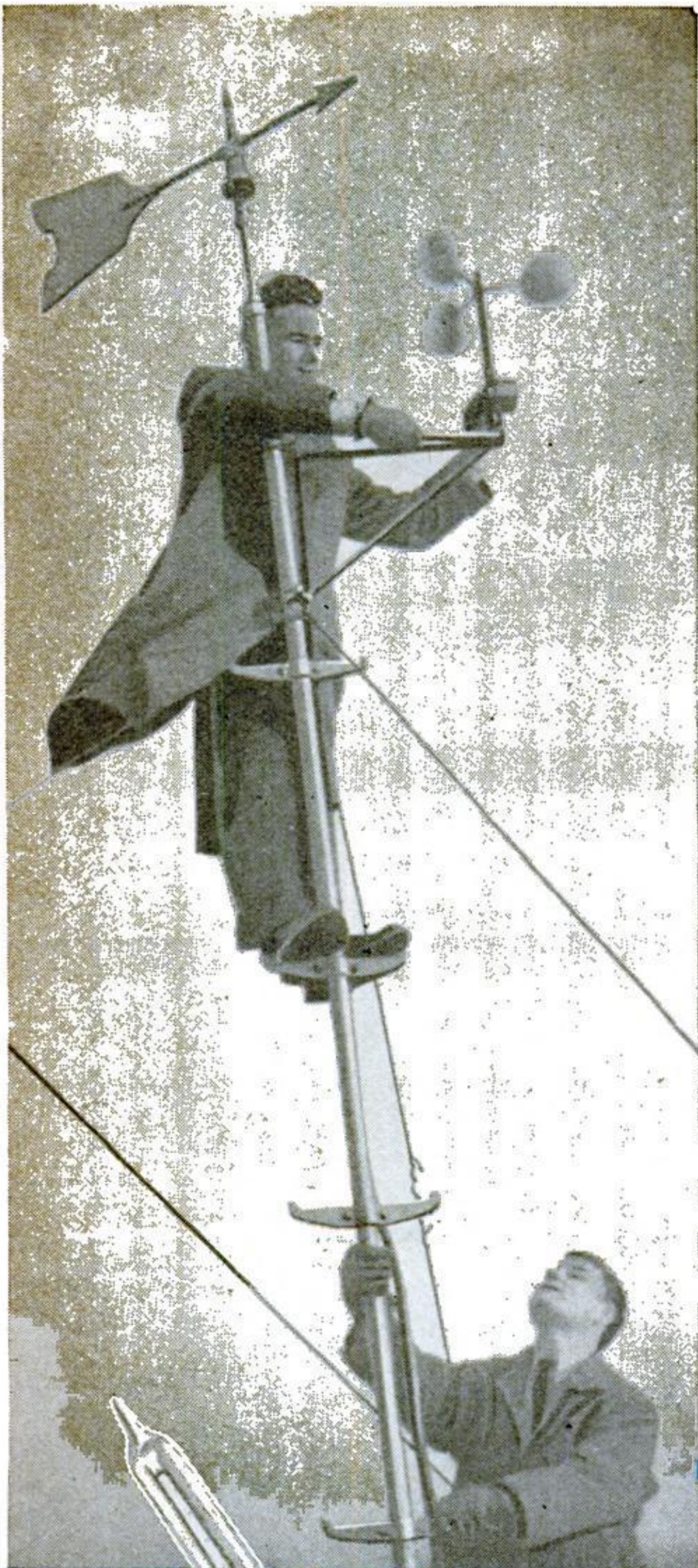
For daytime observation, a student follows the course of a balloon with a theodolite, to measure the angles

letin to all departments of the University.

Looked upon with skepticism by students in other departments when it was begun last November, this local forecasting service has achieved amazing reliability. After careful analysis of their own instrument readings, checked against teletyped reports, these student forecasters even had the audacity to predict a thunderstorm in January—a rare occurrence, depending upon sudden freak



Future weather men learning weather-chart making at the department of meteorology of New York University



conditions in the atmosphere, and seldom predicted by weather men. A terrific thunderstorm actually occurred—its wind, rain, and lightning causing considerable damage along the New York and New Jersey coasts!

The New York University meteorology classes are a direct outcome of the demand for more trained men for the air-transport lines, and all students majoring in the air-transportation branch of aviation are required to attend them. With the new accuracy of weather-predicting methods, however, the value of expert meteorologists in other commercial fields is recognized. As soon as the demand is sufficient, new and specialized courses will be organized. Weather men will be trained for city sanitation departments, electric-light companies, fisheries, scientific farms, moving-picture producers, amusement-park services, and other enterprises where an accurate preview of conditions of rain or shine, cold or heat, might mean the saving of an aggregate of millions of dollars a year.

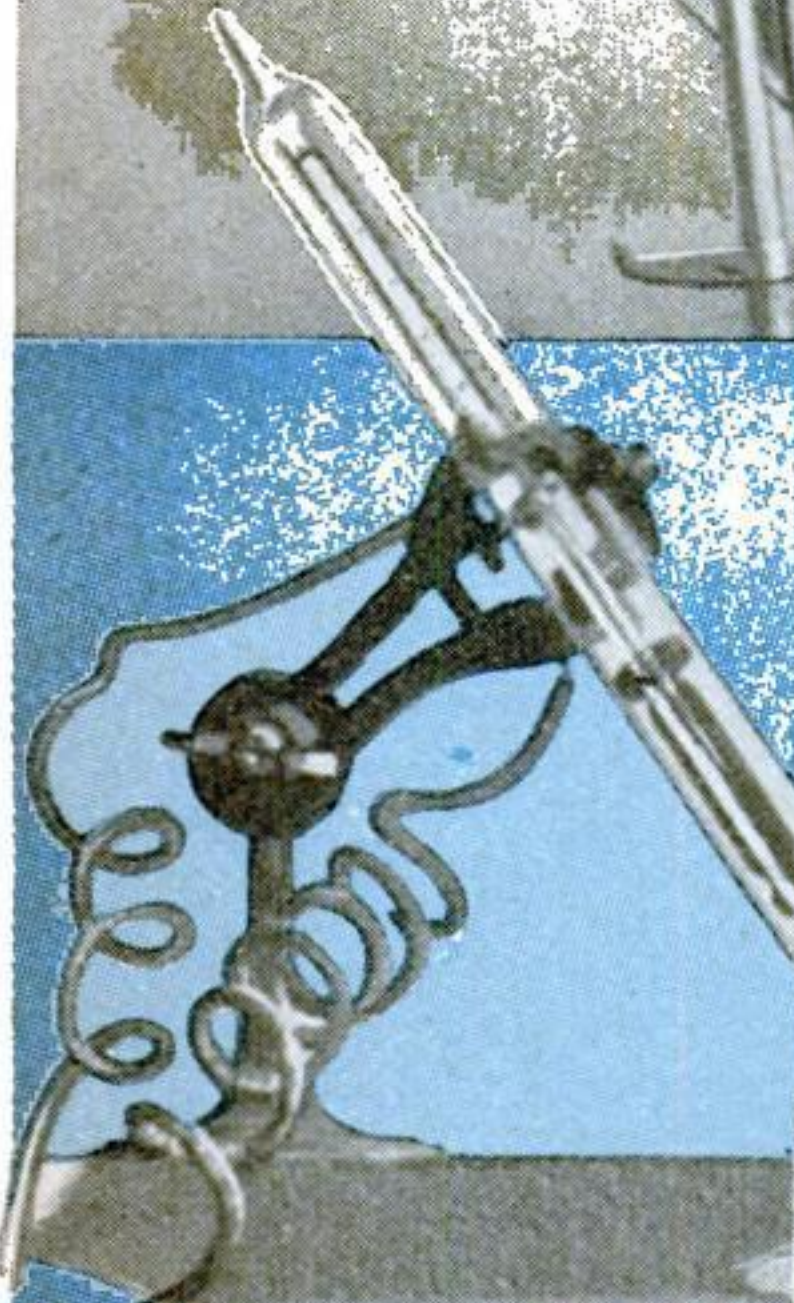
Besides directing undergraduate courses, faculty members and graduate students are conducting independent research—testing new theories and developing new instruments for more precise observation.

WIND VELOCITY

Students adjusting an anemometer, an instrument that tells how fast the wind is blowing. Below is a sensitive rain gauge mounted on the roof of the university observatory in New York

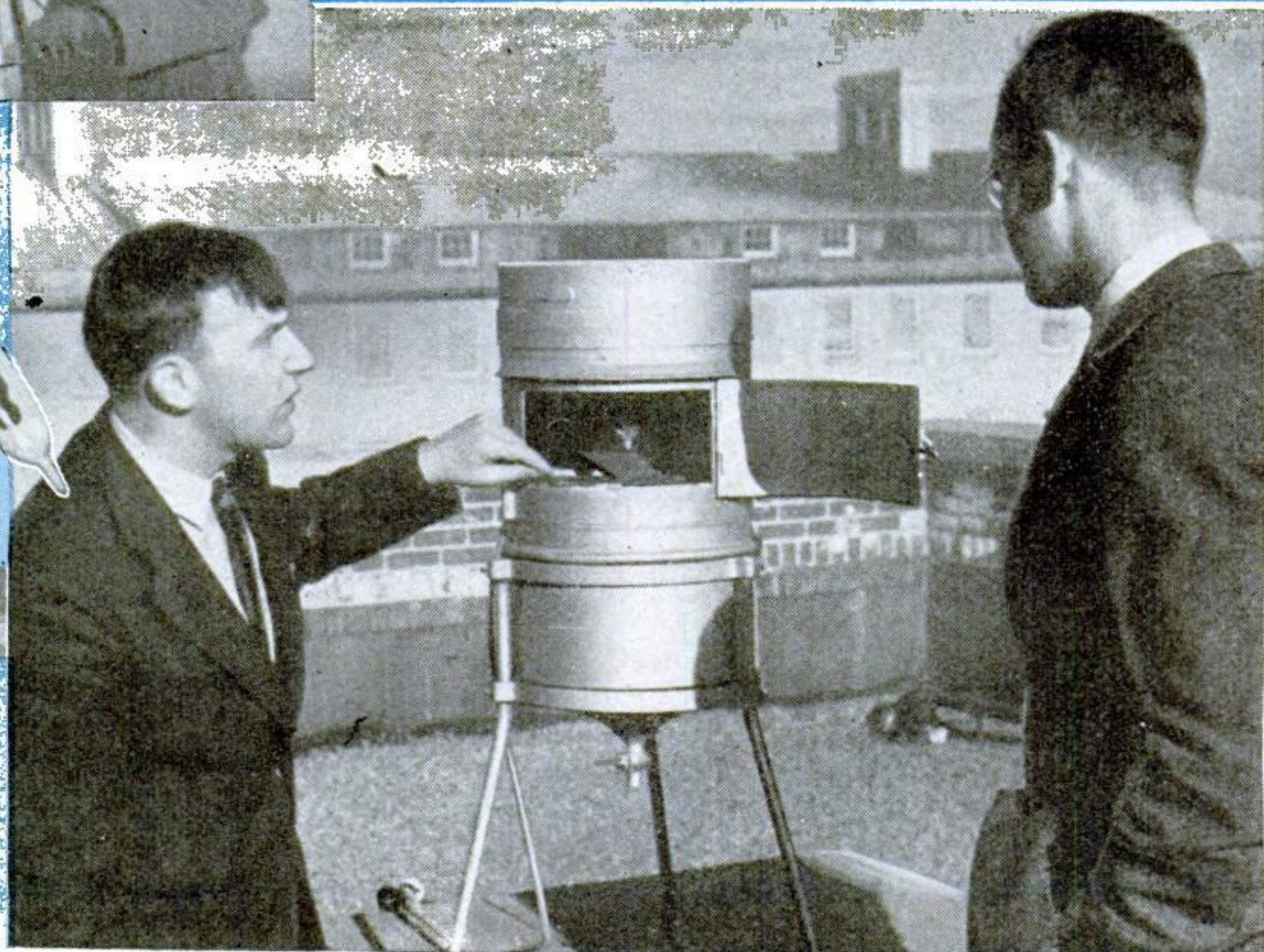
A valuable new method for recording at night the courses of pilot balloons—free balloons sent up to determine the air direction and velocity at different heights—has just been perfected by Prof. Athelstan Spilhaus, head of the department.

The present standard



SUN-HEAT METER

In this curious instrument, heat from the sun affects a thermometer, causing the mercury to make an electrical contact that marks a chart





Weather observatory on Mount Whiteface, N.Y., where students help collect data on high-altitude conditions

procedure is to attach a candle lantern to the balloon, and to attempt to follow this lantern, visually, by means of a theodolite, an angle-measuring device, as is done in the daytime. This is quite difficult, however, owing to the small point of light which must be traced across the big expanse of black sky.

Professor Spilhaus solves the problem by attaching a series of flares to the tail of the balloon, arranging them so that they will

ignite, in succession, at predetermined intervals. Instead of trying to follow the balloon's course visually, the flares are all photographed on the plate of a special camera whose field of view covers the entire sky—180 degrees.

Coöperating with the Rensselaer Polytechnic Institute, of Troy, N. Y., the University also maintains a weather station on Mount Whiteface, N. Y.



HOW THE WIND BLOWS. A budding cloudgazer mans the theodolite while another prepares to release a pilot balloon. At the right, a balloon is being carefully filled with helium, on a balance that measures its "lift." Students test their skill by issuing daily weather bulletins

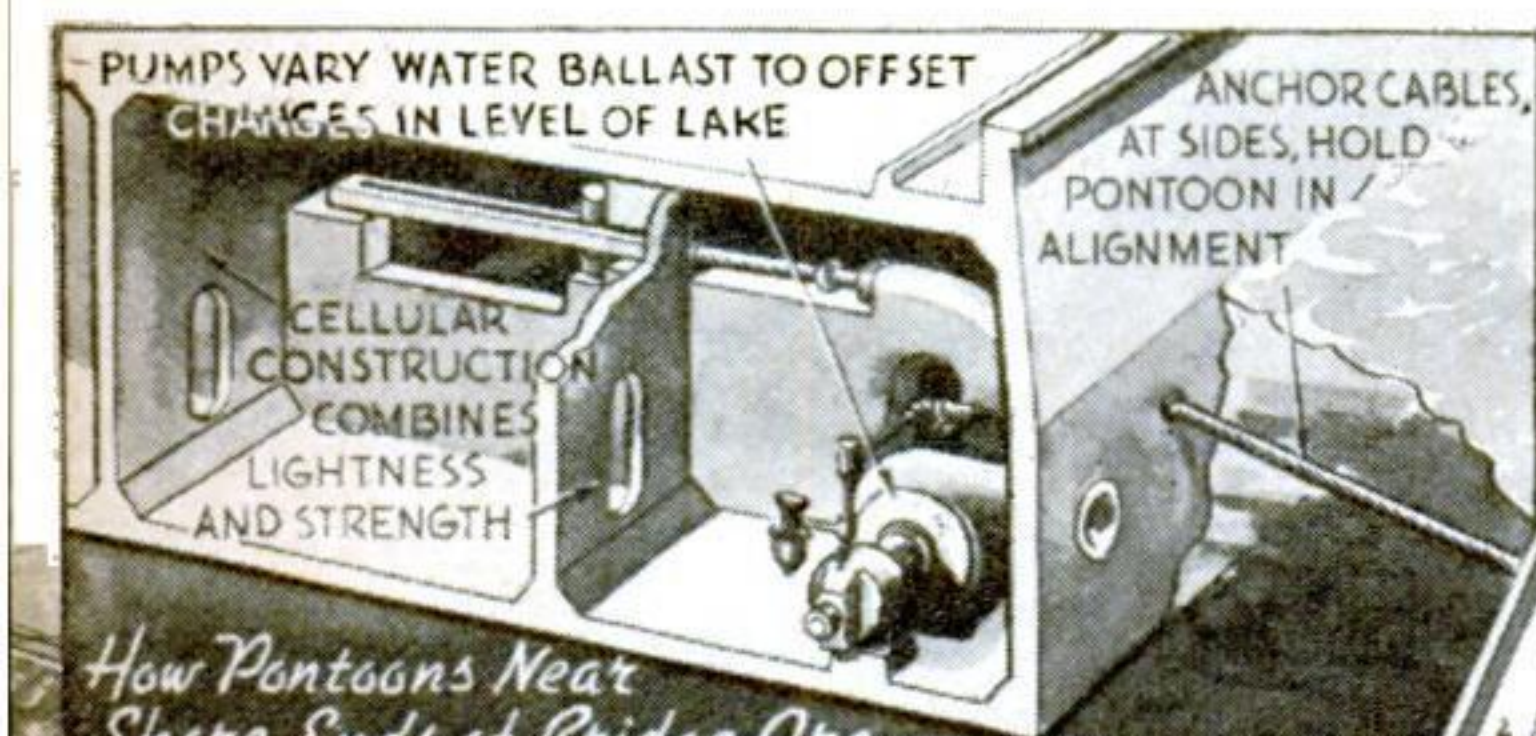


World's Longest Pontoon Bridge

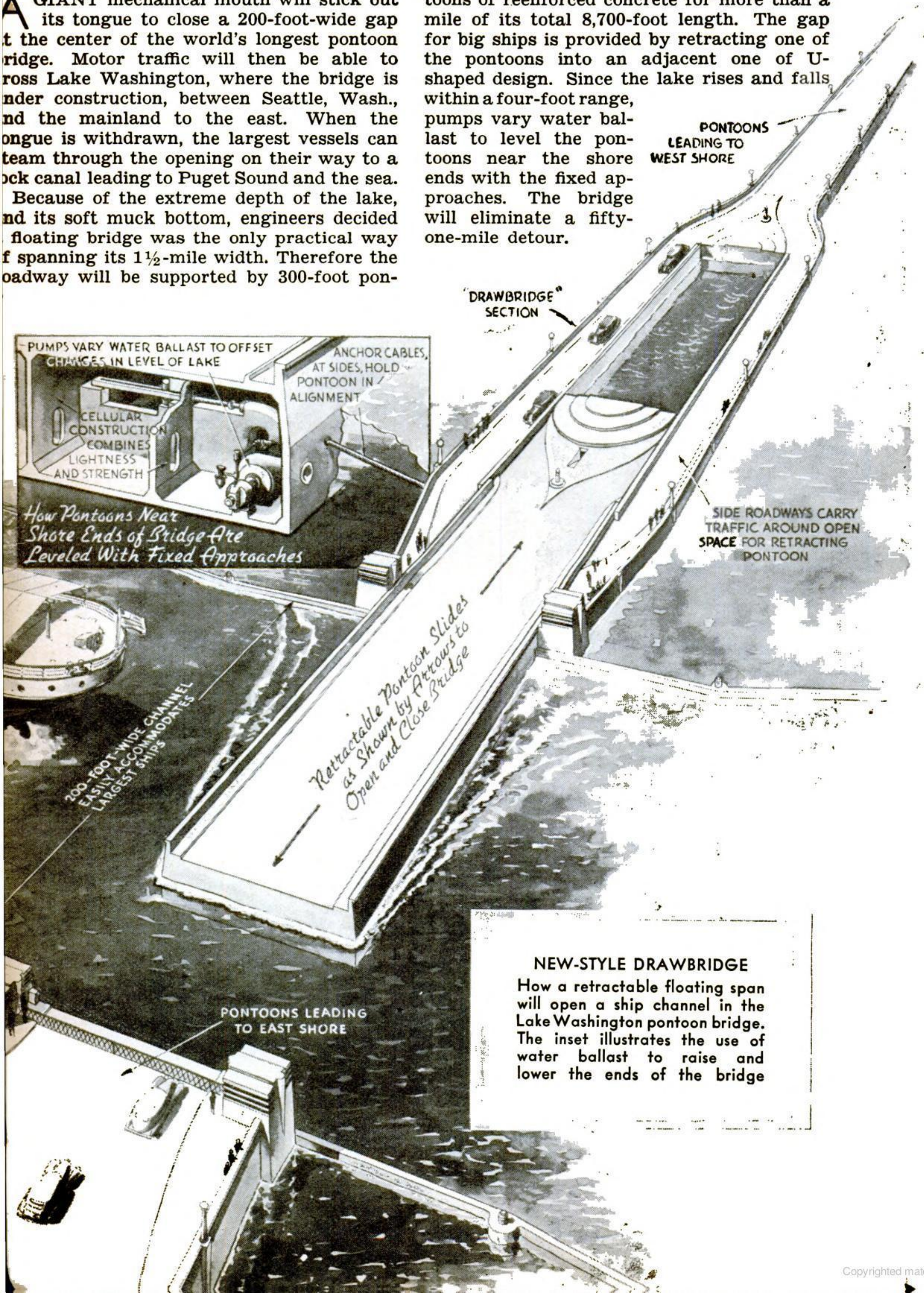
A GIANT mechanical mouth will stick out its tongue to close a 200-foot-wide gap at the center of the world's longest pontoon bridge. Motor traffic will then be able to cross Lake Washington, where the bridge is under construction, between Seattle, Wash., and the mainland to the east. When the tongue is withdrawn, the largest vessels can steam through the opening on their way to a lock canal leading to Puget Sound and the sea.

Because of the extreme depth of the lake, and its soft muck bottom, engineers decided a floating bridge was the only practical way of spanning its 1½-mile width. Therefore the roadway will be supported by 300-foot pon-

toons of reinforced concrete for more than a mile of its total 8,700-foot length. The gap for big ships is provided by retracting one of the pontoons into an adjacent one of U-shaped design. Since the lake rises and falls within a four-foot range, pumps vary water ballast to level the pontoons near the shore ends with the fixed approaches. The bridge will eliminate a fifty-one-mile detour.



How pontoons near shore ends of bridge are leveled with fixed approaches



NEW-STYLE DRAWBRIDGE

How a retractable floating span will open a ship channel in the Lake Washington pontoon bridge. The inset illustrates the use of water ballast to raise and lower the ends of the bridge



Model Plane on a Stick Trains Gunners

BY SIGHTING at a model plane perched on the end of a pole, British novices at aerial gunnery learn to keep a machine gun trained upon a moving target. The picture above

shows a recruit practicing the technique of aiming his swivel-mounted weapon, while he stands within a wooden framework like the machine-gun cockpit of a fighting plane.

Razor Blades Come in Roll

KEEPING plenty of blades on hand is made easy for the user of a safety razor of new design. The blades come in rolls of fifty or 100, inclosed in a convenient dispenser. When a new one is needed, it is snapped off the end of the roll, which slides out like a metal measuring tape.



New blades are just snapped off the end of the roll

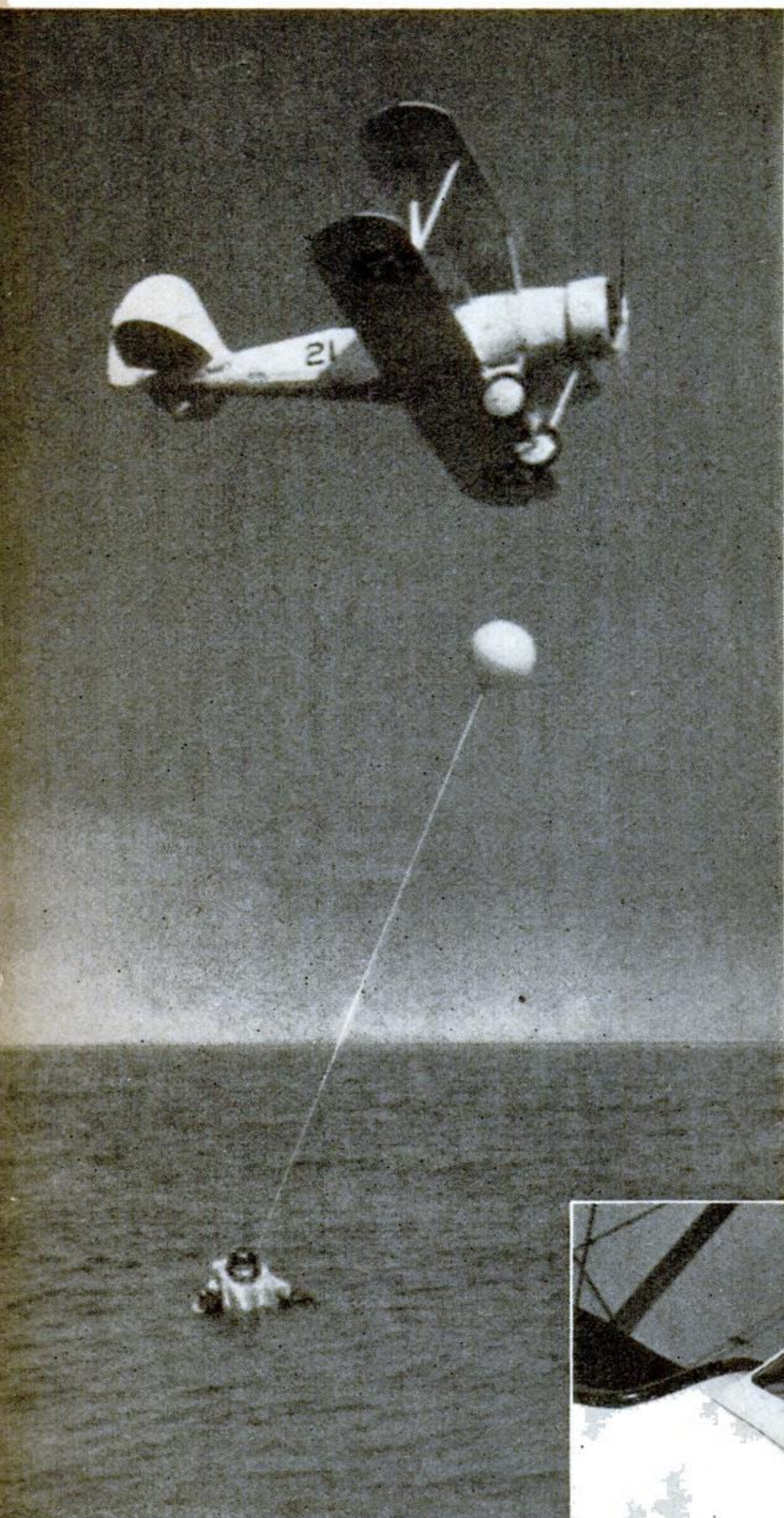


Safety Sandals Save Soles

UNDERSHOES, an innovation for workmen in all types of trades, now minimize fatigue and contribute to comfort when floors are hot, cold, wet, hard, or slippery. Made of resilient rubber and cord fabric, the nonskid, lightweight aids are buckled to street shoes in a moment's time, as illustrated in the photograph above.

Balloons Bring Help to Flyers

TO AID in locating airplane pilots floating on the surface of the water after forced landings at sea, experts at the U. S. Naval Air Reserve Base at Floyd Bennett Field, Long Island, N. Y., have been conducting tests with self-inflating balloons as rescue markers. Fitted with a built-in gas cartridge like those used in life-preserver vests worn by Navy flyers, a deflated balloon is strapped to the arm of a pilot before he takes off for a long over-water flight. If he is forced down and his plane sinks, he yanks a trigger mechanism that punctures the cartridge, causing compressed gas to inflate the balloon. Rising to a height of over 200 feet, the balloon is held captive by a strong cord attached to the pilot's arm as he floats in his special life-preserver vest. Brightly colored, the balloon marker can be seen for miles by rescue planes or ships, whereas a human form bobbing in the waves is often difficult to spot, even at short distances. The photographs on this page were made during tests of the new safety device.



Attached by a long cord, a gas-filled balloon guides rescuers to a shipwrecked pilot, floating in the sea in a life-preserver vest



About to take off on a long over-water flight, this U. S. Navy pilot wears a collapsed balloon strapped to his left arm, and a life-preserver vest that can be inflated

On a forced landing in the water, a pilot pulls this trigger to release helium gas which fills the marker balloon and causes it to rise on a 200-foot cord as a beacon for searching parties





Device Makes Sheet-Metal Maps in Relief

OUTLINES printed on a metal sheet guide the operator of a new electric hammer in the making of relief maps. Working at high speed, the hammer taps out mountains and valleys on the thin metal, leaving an accurate impression of the topography of the area being mapped. Devised by John Braund, cartographer of the United States Coast and Geodetic Survey, the device is expected to speed up military map making.

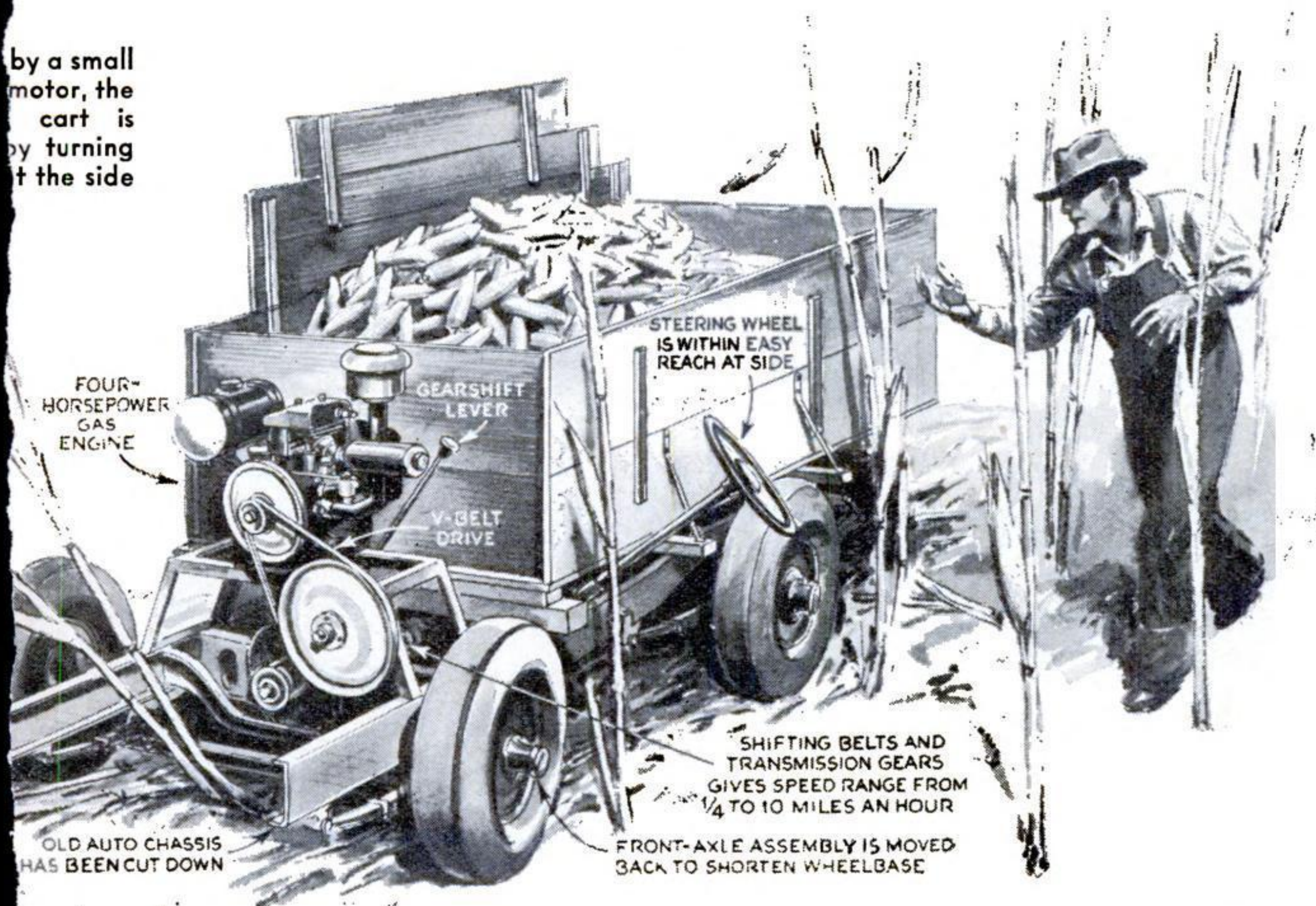
Electric hammer shapes the thin sheet of metal to form the relief map

Horseless Farm Wagon Follows Picker

ROLLING beside a corn picker, on a horseless, low-speed, motorized wagon designed at Iowa State College receives the ears of corn the picker tosses aboard. The steering is set within easy reach at the side. In the present of the design shown below, "bang

boards" at front and rear control the accelerator. If the wagon is going too slowly, throwing an ear of corn at the rear board will speed it up; if it is going too fast, hitting the front board slows it down. The wagon is also intended for loading potatoes and other crops.

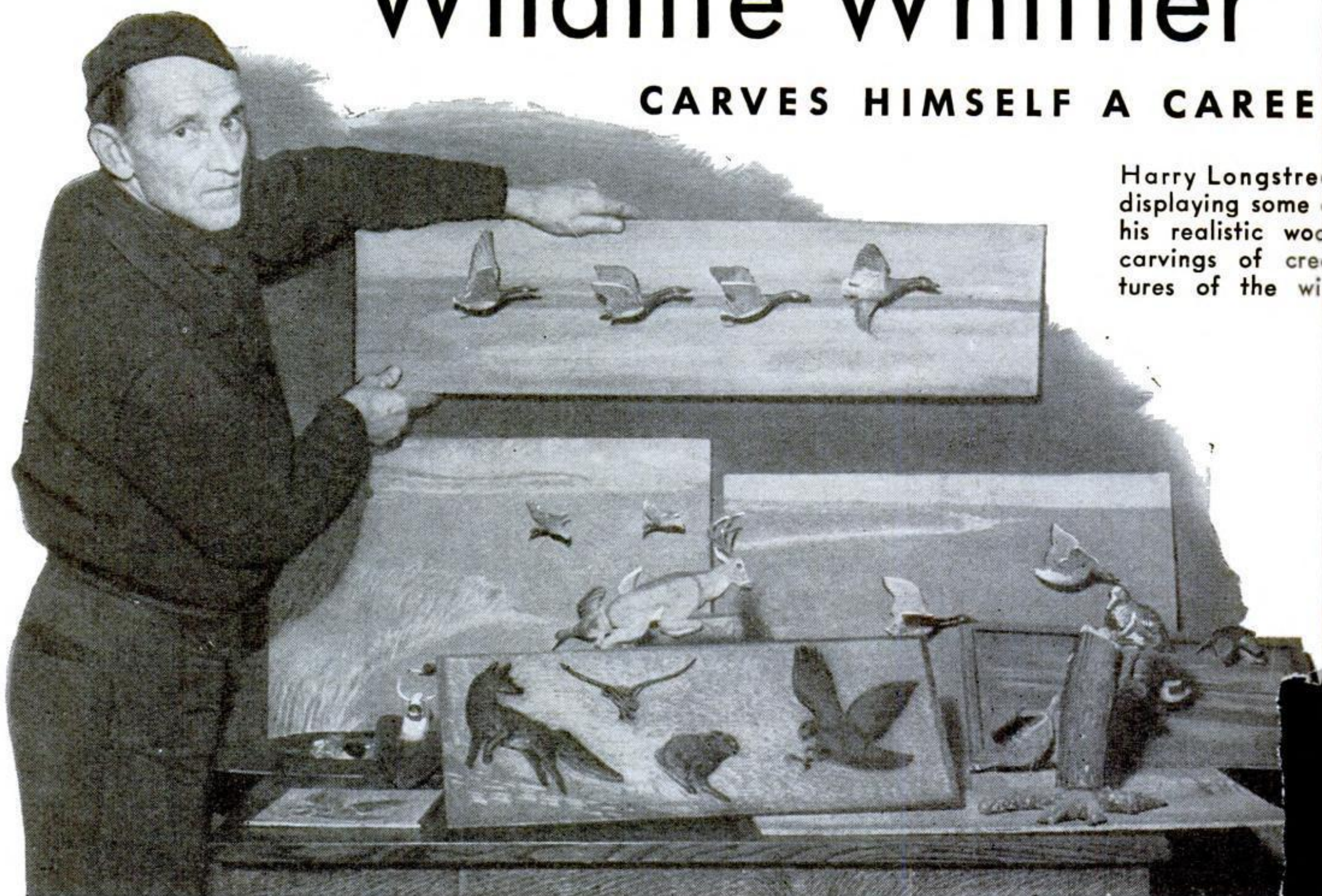
by a small motor, the cart is steered by turning the side



Wildlife Whittler

CARVES HIMSELF A CAREER

Harry Longstreet displaying some of his realistic wood carvings of creatures of the wild



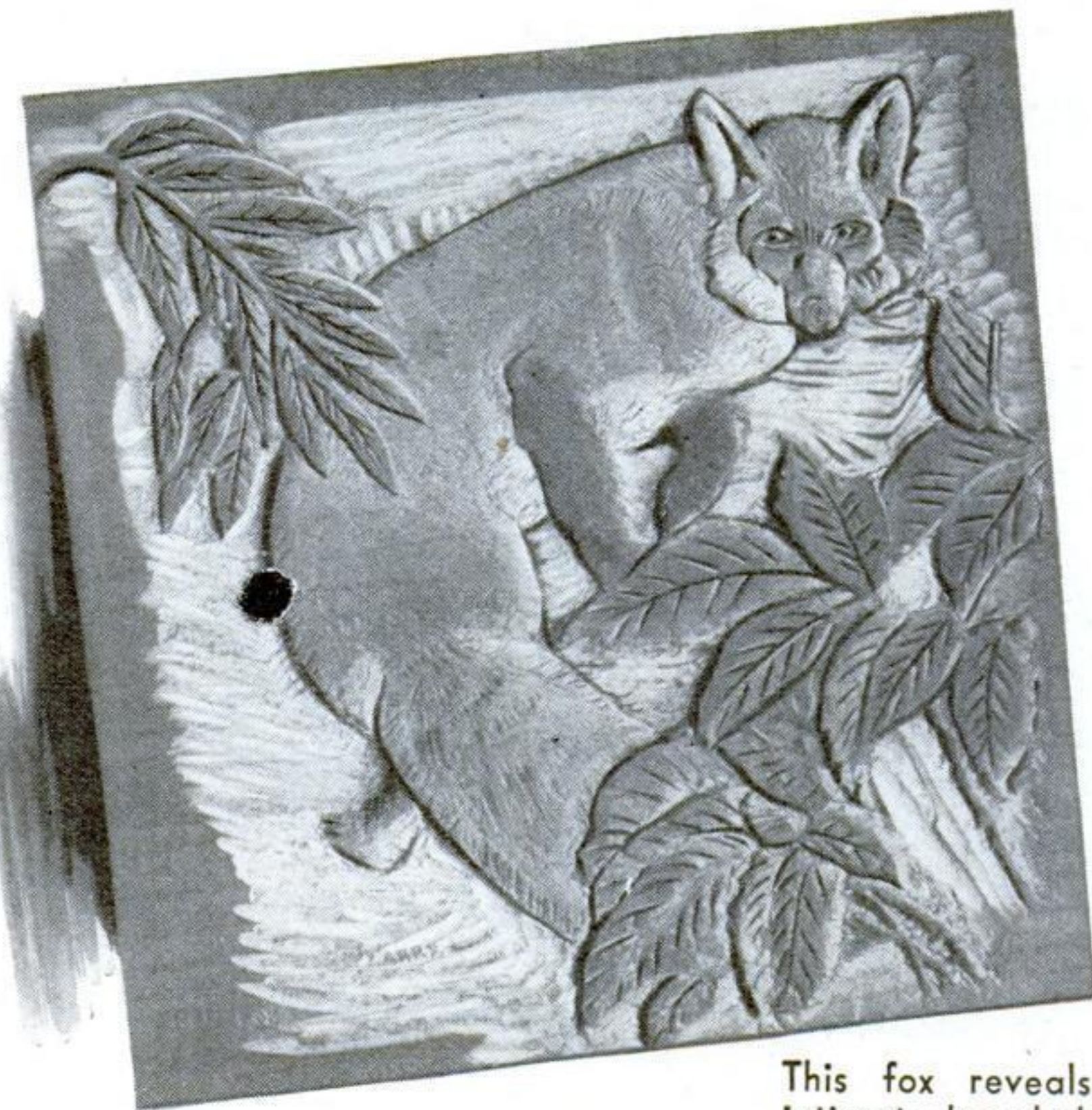
SINCE he lost his job a couple of years ago, Harry Longstreet, New Jersey powder engineer, has won fame through the development of an unsuspected talent for wood carving. Longstreet is a veteran hunter and woodsman, and began carving scraps of wood that littered his cellar workshop

after he had made some decoy ducks. He produces realistic carvings of wild birds, swooping eagles, flying geese, and leaping deer—and his work is being widely exhibited at hobby shows and exhibitions. A few months ago it attracted crowds at the annual Sportsman's Show held at the Grand Central Palace, in New York City.

All the carvings are produced with an ancient jackknife and four simple gouges. In reproducing in wood the creature of the wild with which he is familiar, Longstreet first draws the outlines on blocks of white pine. He keeps erasing and changing the lines until the result responds to what he has seen. Then he sets to work with his cutting tools.

Sometimes, he spends as long as twenty-six hours whittling out a bird no bigger than your hand. Each carving is different. His flying geese, for example, are represented in a wide variety of attitudes, all easily recognized by a hunter as true to life.

Backgrounds are painted in with ordinary house paint while the carvings themselves are tinted with a variety of paints and stains. The familiar red and black septic, mercurochrome, provides the ground color for a miniature deer's head and for the background on a carving of a trout.



This fox reveals the artist's intimate knowledge of animals

By EDWIN TEALE

In addition to scraps left in decoy making, Longstreet carves driftwood picked near the Barnegat Light-house, on the Atlantic Coast. One of his most striking pan-showing a fox sniffing air, and an owl and an eagle swooping down on a hatching cottontail, was made from a piece of mahogany which had floated ashore from the wreck of a German cruiser.

Up until three years ago, Longstreet never realized that he had any special talent for carving wild creatures from wood. Deeply interested in studying game birds, he made his first carvings to sell at conservation talks to Boy Scouts and other groups. They attracted an ever widening circle of attention and a number have been purchased for dens and rooms by sportsmen. Unhappily, Longstreet is literally carving out a new career.



Longstreet at work in his basement shop. He uses only the simplest tools



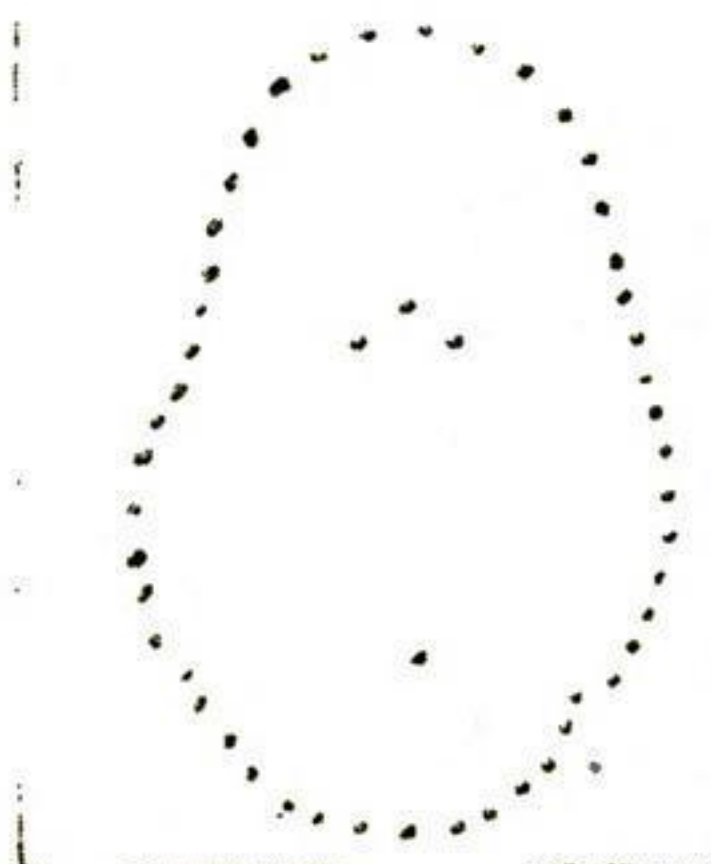
Not being measured for a new hat. The device records the head shape, as seen at right

Head Measurements Help To Identify Criminals

A DEVICE long used by hat stores, to measure the size and shape of a customer's head, now helps police of Norwalk, Conn., to identify criminals. According to sponsors of the new method,

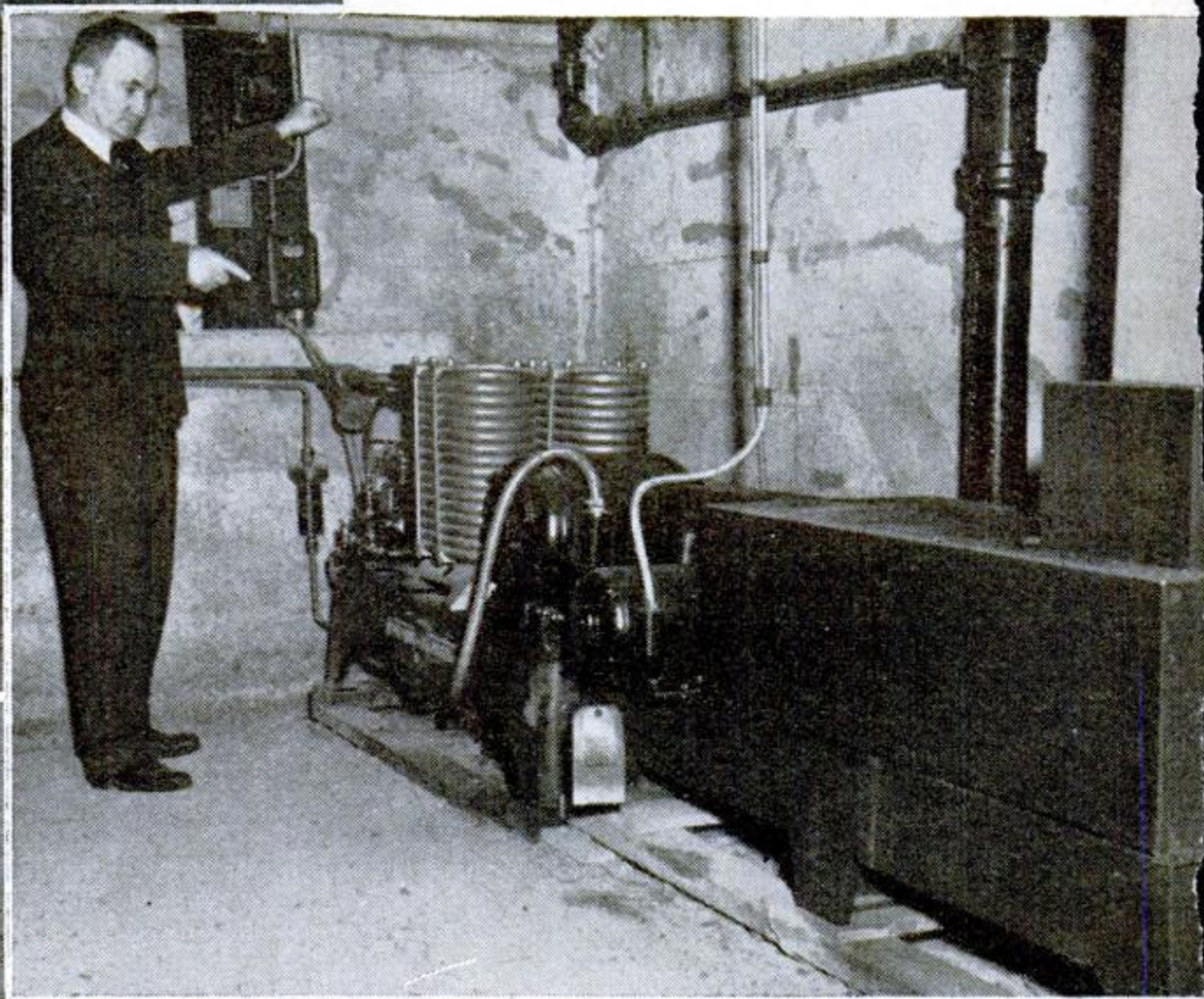
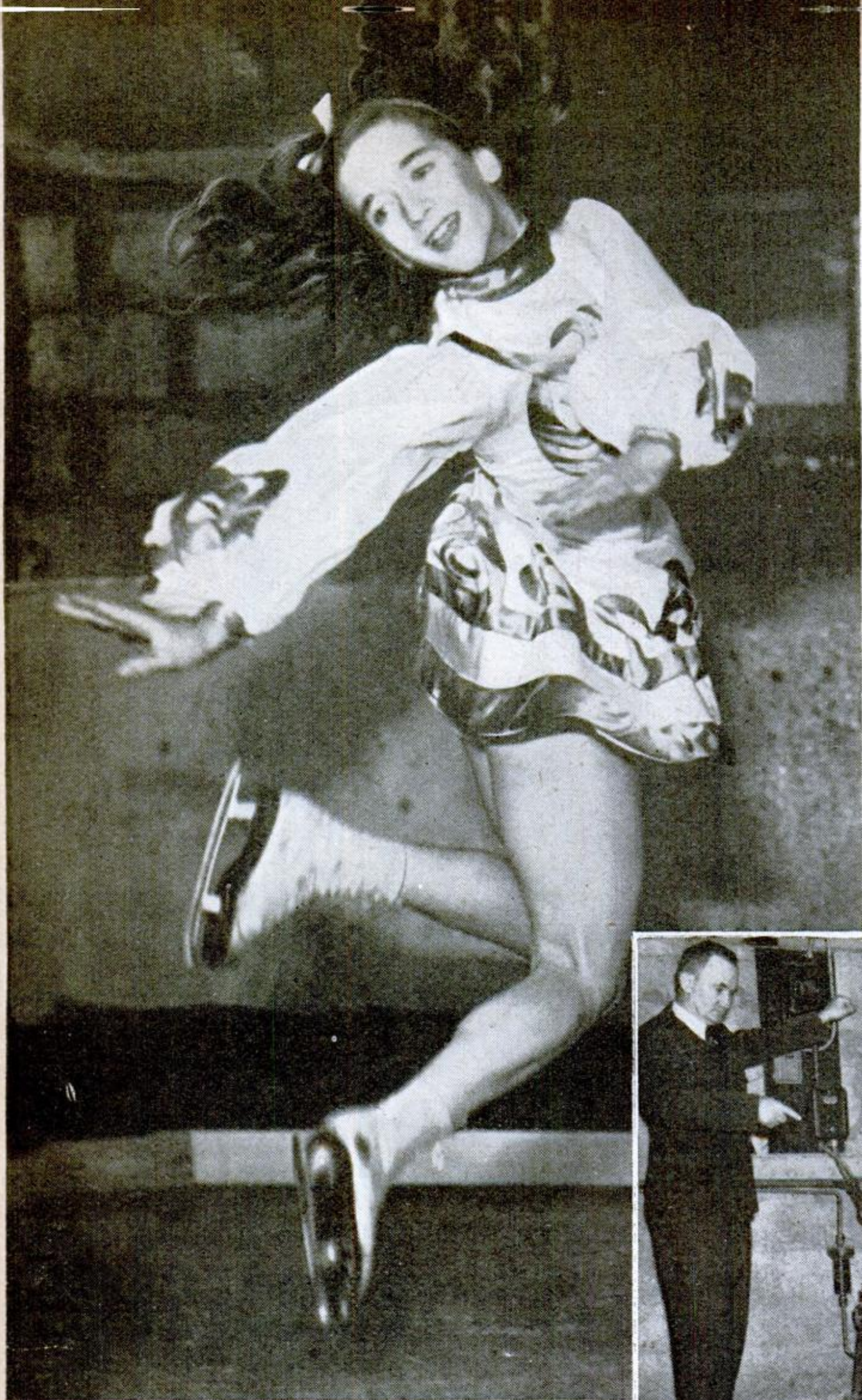
who use it in conjunction with fingerprinting, no two men have heads of exactly the same shape. Therefore, the perforated contour patterns produced by the device will afford a check on a suspect's identity, and may prove particularly valuable if he has attempted to alter his fingerprints by chemical or surgical means. Since he cannot change the contour of his skull, this would remain as a telltale clew to his identity.

POLICE DEPT
NORWALK, CONN



Girl Skater Trains on Homemade Rink

PRACTICING her ice-skating routine in spite of midsummer heat presents no problems to Adele Inge, twelve-year-old figure-skating expert, since her father completed a homemade ice rink in the basement of a frame and plaster-board gymnasium which he constructed near their home in Clayton, Mo. Measuring about twelve by twenty-six feet in area, the cellar rink was built up from the ground level in layers of cinders, concrete, and cork, with freezing coils laid an inch and a half apart in sand, under a top one-inch covering of concrete. When the surface is flooded, a standard, electrically operated refrigerating unit freezes the water into a smooth, even surface for summertime ice skating, as shown in the photograph reproduced below.



Adele Inge, twelve-year-old figure-skating expert, putting on her skates for summertime practice on her own ice rink built into a basement gymnasium. Inset shows the standard refrigerating machinery. At top, Adele in one of her specialty numbers



SWEET
★
ADELE

A "casualty" during a gas-attack drill being carried to the motorized hospital



Mobile First-Aid Station Is Built Into Bus

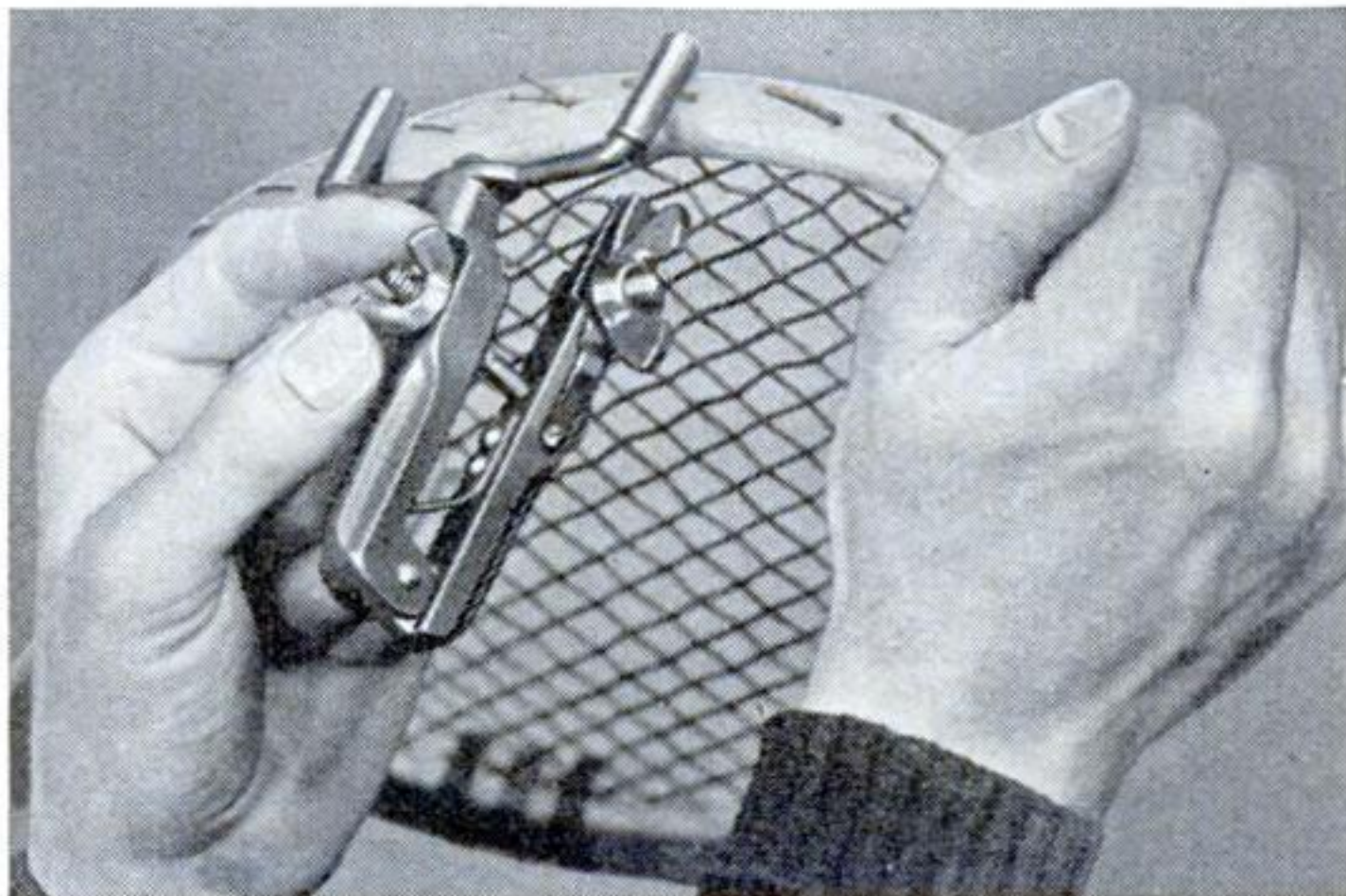
FITTED with folding sides, a remodeled double-deck passenger bus serves as a mobile first-aid station to furnish emergency medical treatment to civilians in areas that might be ravaged by bombing in case of wartime air raids. The latest development in English preparations for air-raid defense, the medical bus travels with its side extensions folded against the body of the vehicle to allow for clearance along narrow roads or in highway traffic. In use, the sides open out, as shown above, to form two receiving rooms, one for men and one for women, where minor injuries may be treated or major cases prepared for transfer to the operating room in the center of the bus. The back of the vehicle has storage space for medicines, bandages, stretchers, and other equipment, while the upper deck provides living quarters for the medical staff of the mobile field hospital.



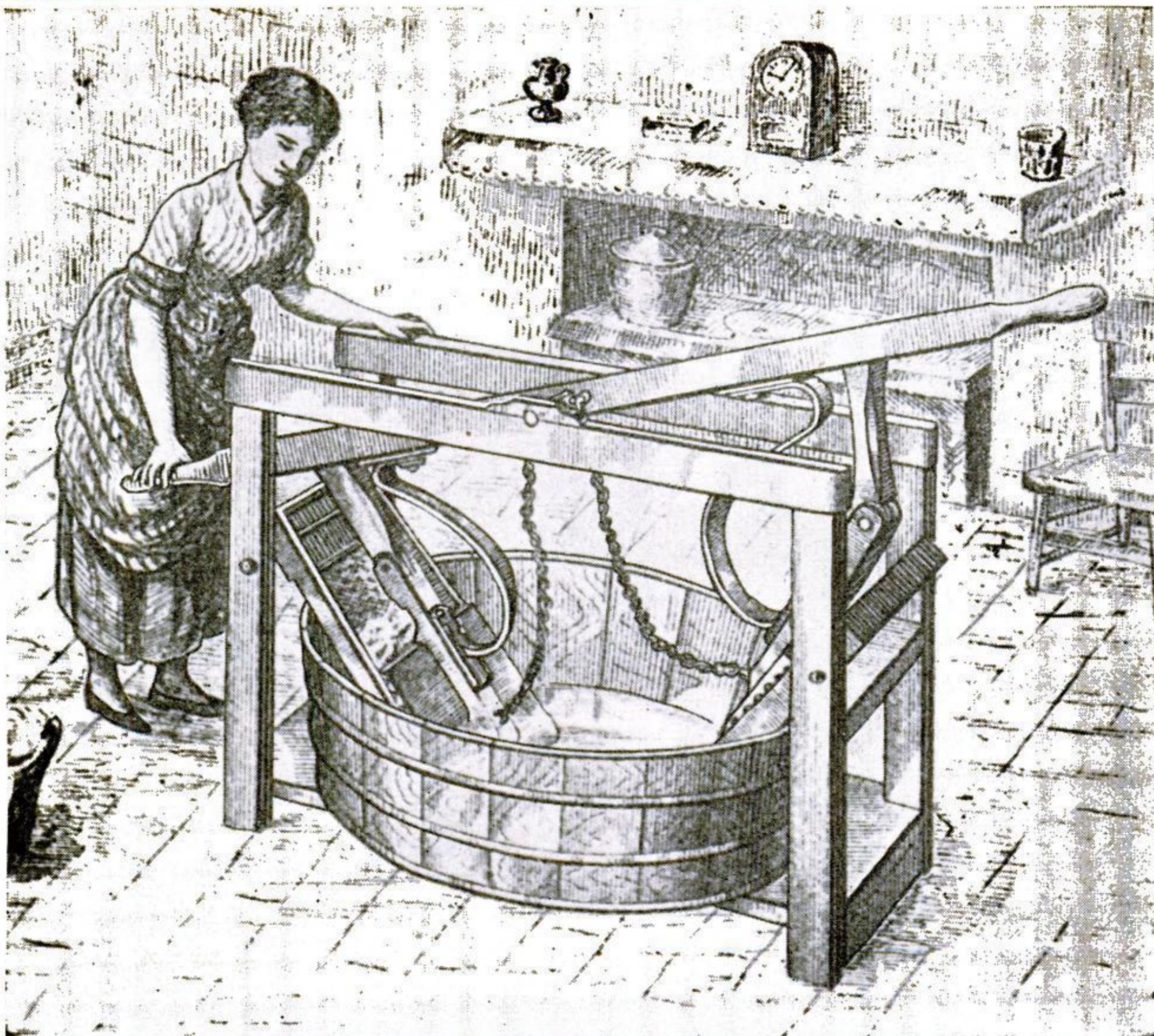
In transit, side compartments are folded

Clamp Simplifies Repair of Tennis-Racket Strings

REPAIRING or replacing a broken string in a tennis racket is made easy with the hinged clamping device pictured in use at the right. While extensions on the clamp are braced against the racket frame, the broken gut string is held in a tiny vise operated by a thumbscrew. Turning a second thumbscrew draws the clamp's hinged sections together, thus tightening the string to the desired tension and making it possible to fasten its end in place on the racket frame.



Turning the thumbscrew pulls the broken string taut



Grandma Thought It Amazing

WHEN Grandma complained that scrubbing clothes was ruining her hands, away back in 1883, Grandpa brought home the latest thing out—a machine to do the washing! She pumped its massive wooden handle with a will, and it impartially separated stains, stitches, and buttons from the soapy garments

that it ground back and forth over a pair of washboards. Powerful springs bore down upon notched paddles to make the work of destruction complete. This was one of the first washing machines invented, and it took more than a half century for this mechanical monstrosity to evolve into the sleek, electrified models of today.

Comb on Tube Cap Applies Mascara

FOR applying mascara to eyelashes, an ingenious inventor has combined a miniature comb with the cap of the container. Saturated with cosmetic when withdrawn, the novel applicator is used as shown and then replaced, avoiding waste.



After use as shown, the tiny mascara comb is replaced in the tube

Camera-Car Ladder Gets Novel Shots

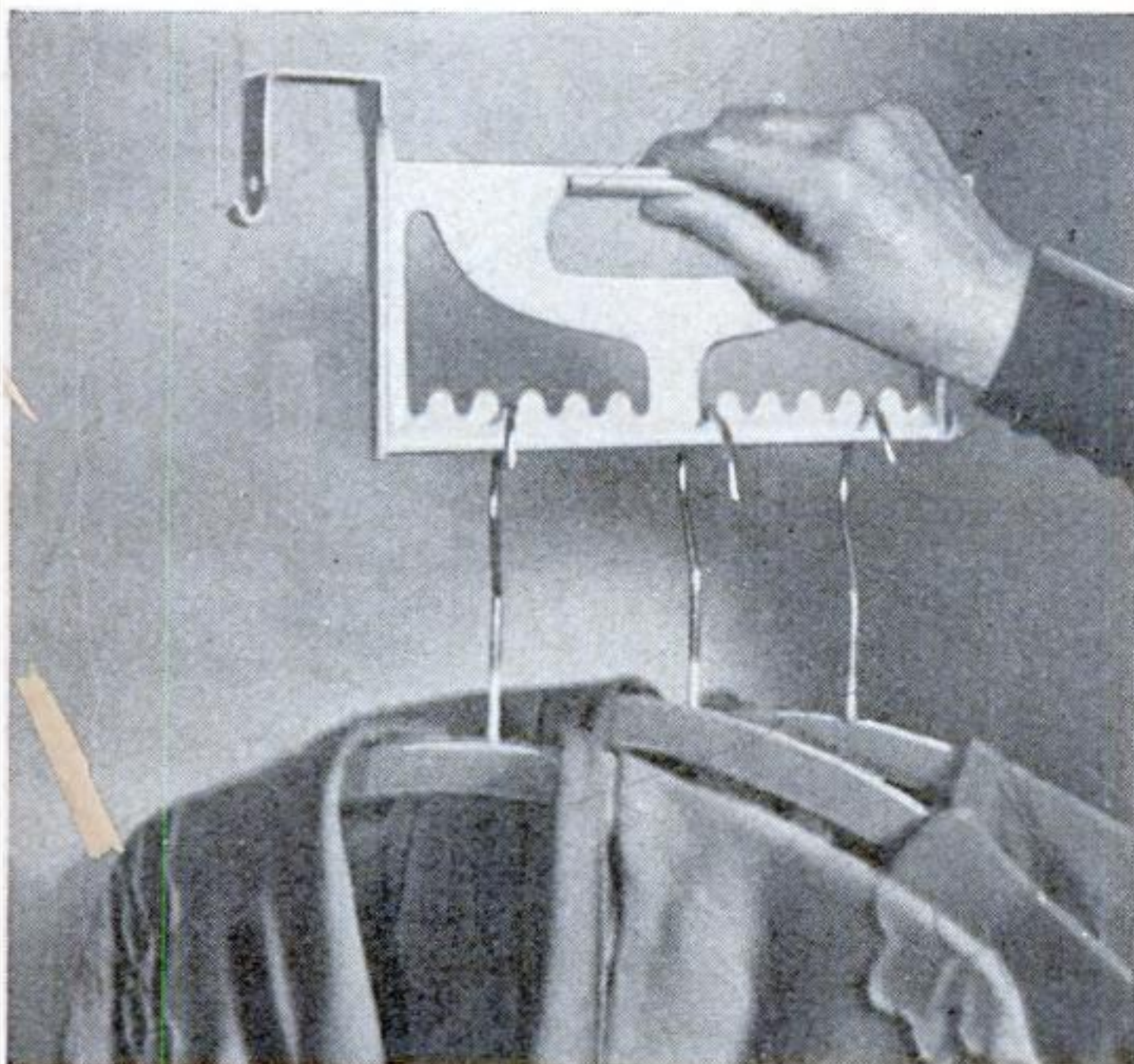
TO HELP cameramen shoot photos over the heads of crowds, and from interesting angles, a Los Angeles, Calif., news-picture truck employs a tall ladder as an aerial point of vantage. Equipped for developing the pictures as it speeds back with them, the traveling laboratory is seen below in action during a demonstration of modern antiaircraft guns by the U. S. Coast Artillery.

Photographers snapping a bird's-eye view of an antiaircraft-gun crew in action, from a ladder on the camera truck



Garment Rack Is Portable

HOOKEED over a door or permanently nailed or screwed to a wall, the convenient coat rack shown below solves the problem of limited closet space. Twelve garments may be hung from its notched bar, and a handle makes it easy to carry the rack and its load wherever it is wanted.



A handle allows the handy rack to be carried about



"Mike" Provides Spotlights

MICROPHONE and spotlights are combined in a new accessory, shown above, for dance orchestras. The microphone, at the center of the stand, picks up a singer's voice for amplification. Meanwhile two midget lamps at the sides, patterned after the mike, throw a soft, shadowless light on the performer's face.

Plane Sows Lakes with Young Trout

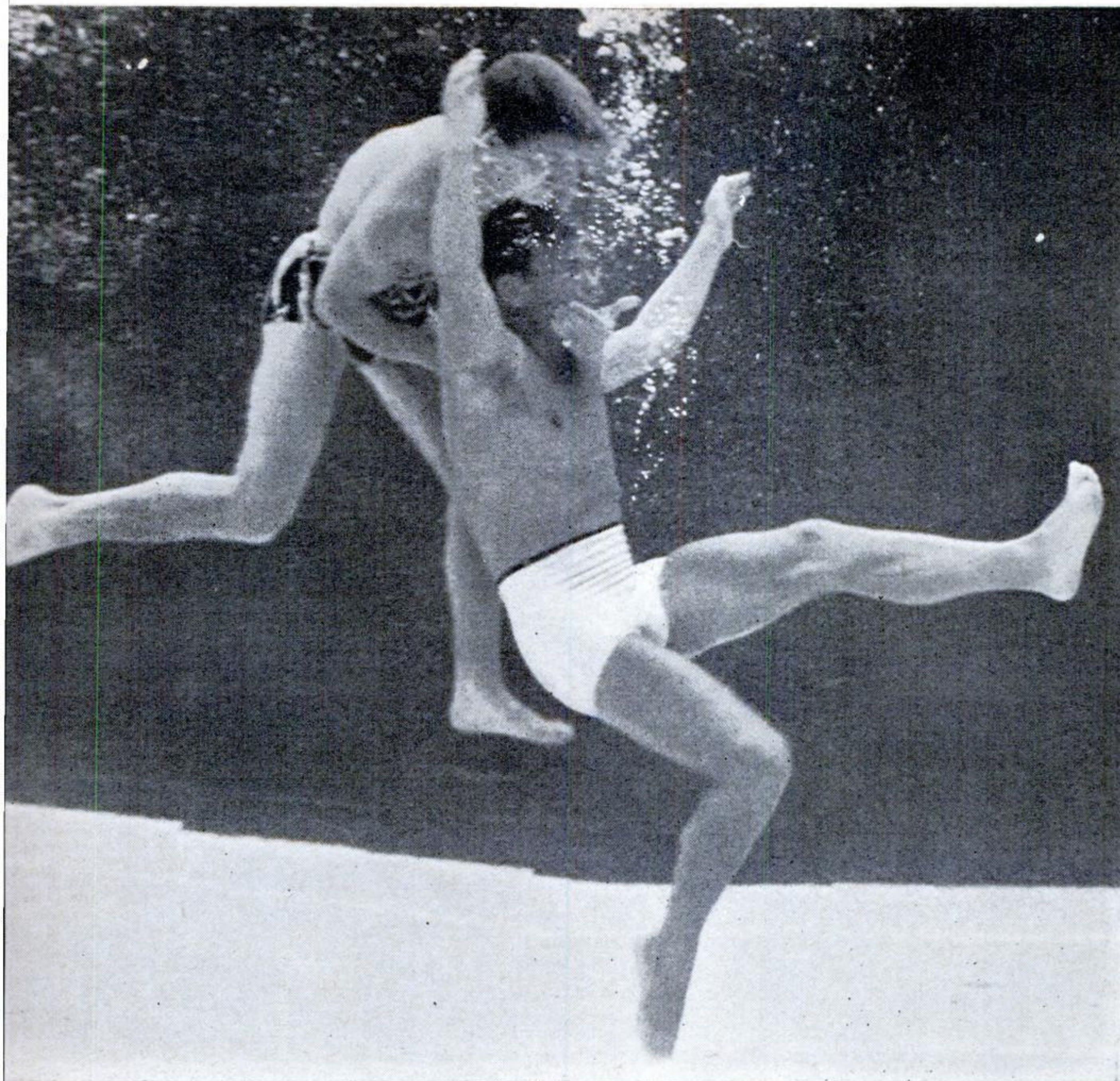
TROUT rain down from the sky under a novel fish-stocking plan conceived and directed by Gustave Prévost, Canadian conservation expert. From a hatchery sixty-five miles northwest of Montreal, young trout are loaded into special containers placed in the cabin of a novel plane. This ship is equipped with a sizable funnel in the fuselage floor, leading to a rubber tube that trails downward and toward the rear while the plane is in flight. During transportation to wilderness lakes farther north, oxygen is released into the fish containers to aerate the water. Swooping down over a lake, the plane pilot releases a valve, dumping thousands of tiny fish through the rubber tube and down into the water. Careful preliminary tests revealed that fish could be dropped from heights as great as 500 feet without injury.



Young trout dropping from a plane into a Canadian lake. They fall as much as 500 feet without harm



Through this specially designed funnel and tube, lakes are "bombed" with fingerlings. At the left, a wire basket containing small fish is being removed from a hatcheries truck to be placed in a tank in the plane



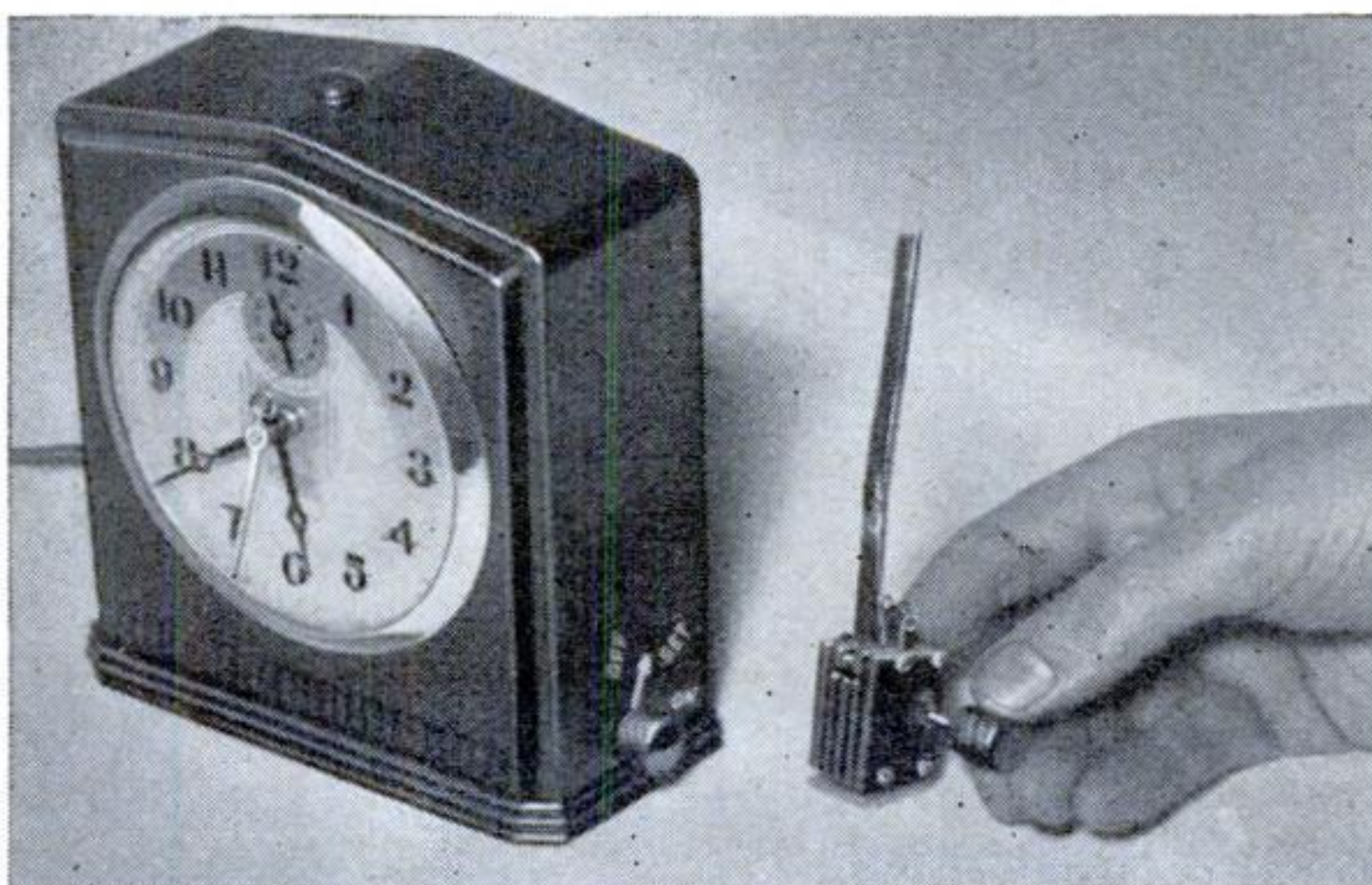
Wrestlers Stage Underwater Battles

SUBMARINE matmen are staging underwater wrestling matches in a swimming pool, a novel attraction for vacationing visitors at a Atlantic seaside resort. Viewed through

glass windows in the walls of the swimming tank, the wrestlers seem to be staging a slow-motion bout as they make and break holds beneath the surface of the water.

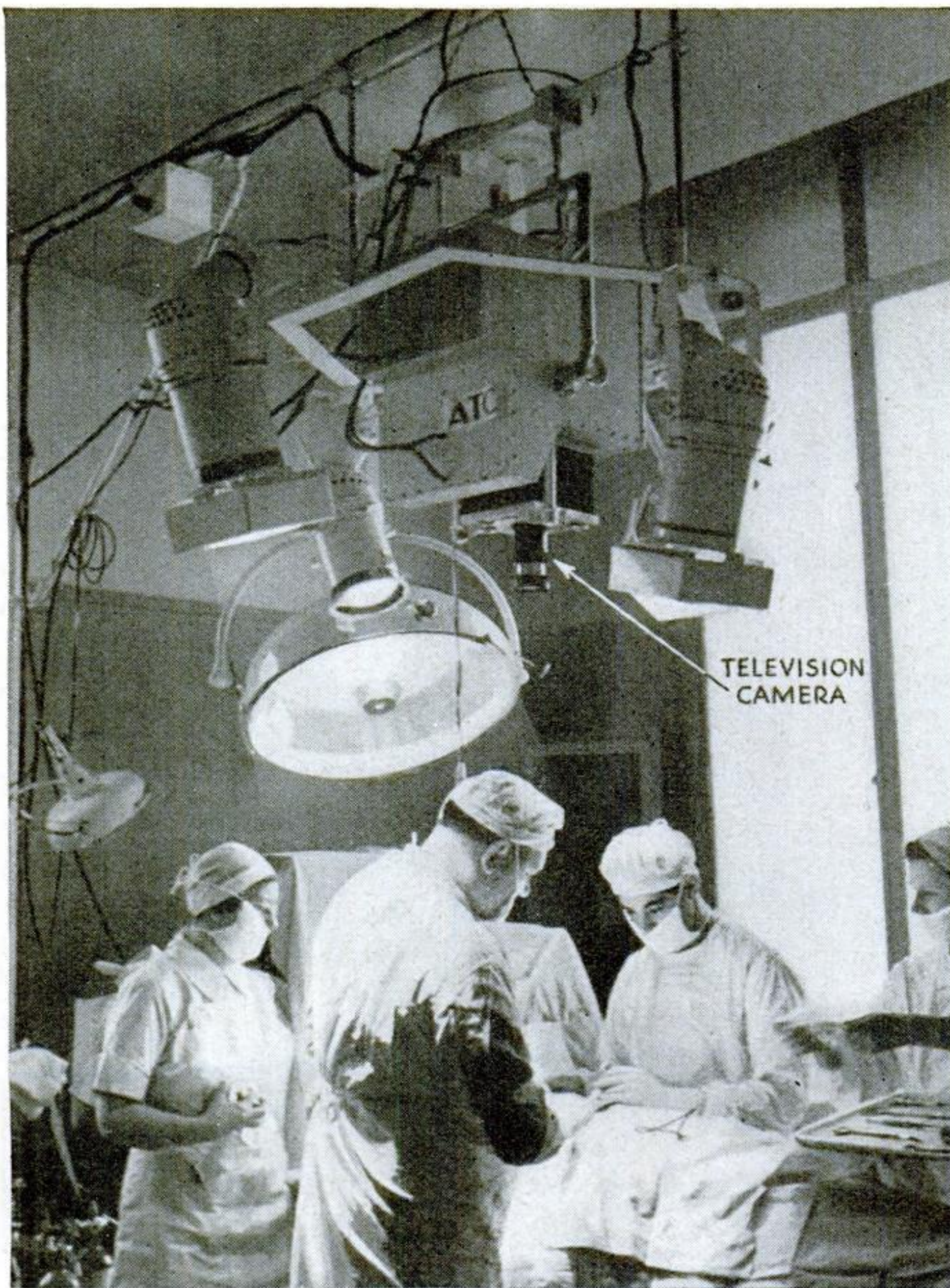
Switch Fits Clock's Alarm Mechanism

ELECTRIC or spring-operated clocks use time clocks for turning electric appliances on or off automatically. A newly fitted with a low-cost switch recently invented. The switch has a control arm which is tripped by the clock's alarm mechanism, so that current is switched on or off when the alarm sounds at a predetermined time. Installation does not disturb the mechanism of the clock.



The compact time switch is installed inside the clock case

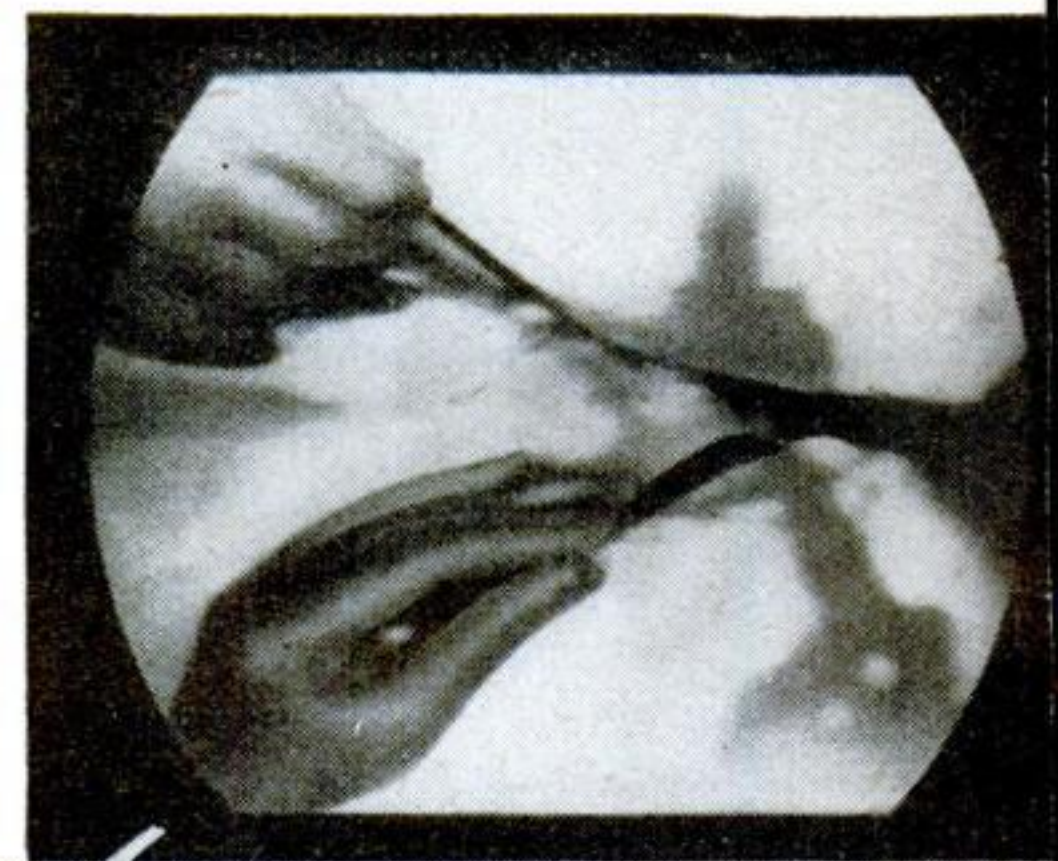
Television Lets Students Watch Operation



A delicate operation being performed under the "eye" of the television camera

MEDICAL students now look on by television, while skilled surgeons perform operations at Israel Zion Hospital in New York City. Permanently installed after a successful tryout, the system gives more than 100 spectators a close-up view of what is happening, and enables them to hear the surgeon's own comments on his procedure. Previously, students have had to watch operations from remote and crowded galleries, depending on blackboard

notes and textbook illustration for what they missed. In the new installation, a television camera occupies a point of vantage directly above the operating table. Cables transmit the images to six viewing screens, each large enough for twenty to thirty persons, in a spacious auditorium. The surgeon's voice is picked up by a microphone at the head of the operating table, and is heard by the audience through loudspeakers. In the initial trial, a delicate abdominal operation was performed beneath the television camera. It "came through" so realistically that students involuntarily broke into applause at the deft completion of difficult steps by the surgeon.



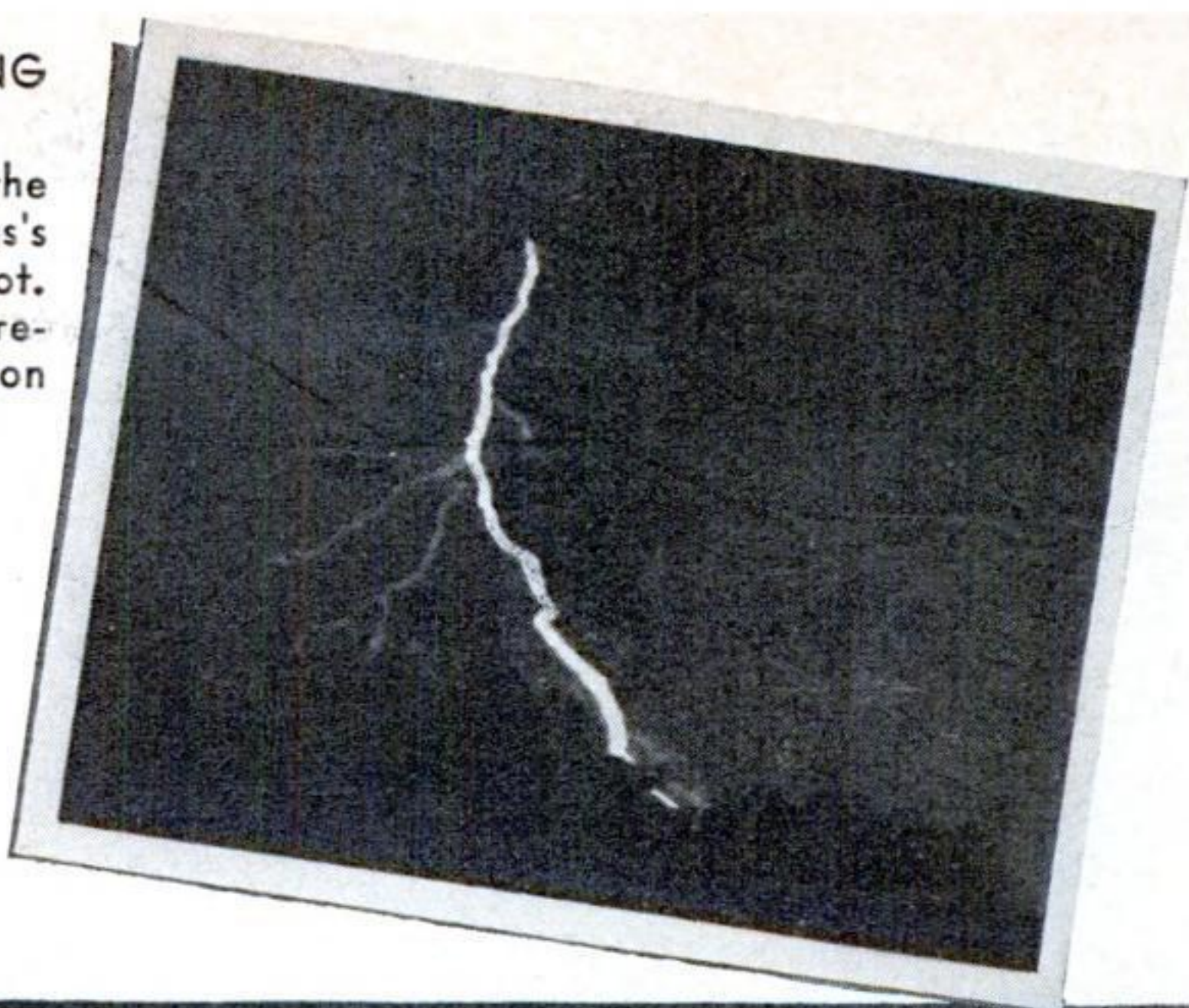
Students grouped before one of the viewing screens. Inset shows what the



"Carbon lightning," photographed from a train in 1900, shows how lightning spread out by the wind

THIS PICTURE PROVED LIGHTNING ISN'T ZIGZAG

The photograph at the right was Jennings's first successful shot. Made in 1882, it created a big sensation



Still pursuing his hobby of lightning photography, W.N. Jennings now uses the eight-by-ten aero camera below



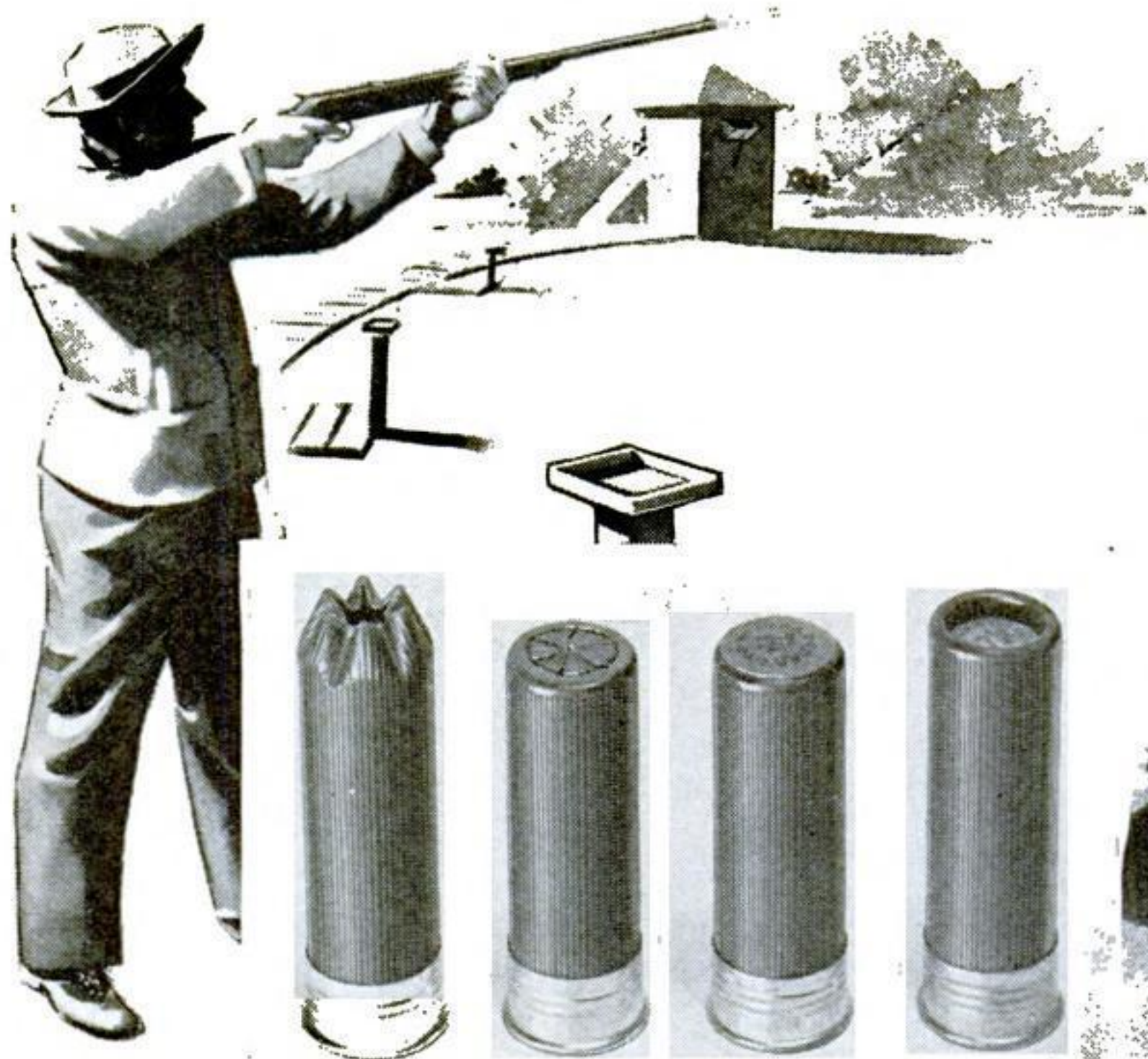
Pioneer Lightning Photographer

LIGHTNING is symbolized for visitors to the New York World's Fair by a ten-ton, stainless-steel "thunderbolt" of zigzag shape. Once people thought lightning really looked like that. Few know how a young Philadelphia road man, William N. Jennings, first revealed its true nature.

Photography was still in its infancy, about 20 years ago, when Jennings took up the hobby with a four-by-five plate camera. Suspecting that lightning bolts were not of the zigzag form pictured by artists, he tried to photograph them. His first efforts proved unsuccessful; the photographic plates available were not sensitive enough. Jennings refused to be discouraged, however, and a year

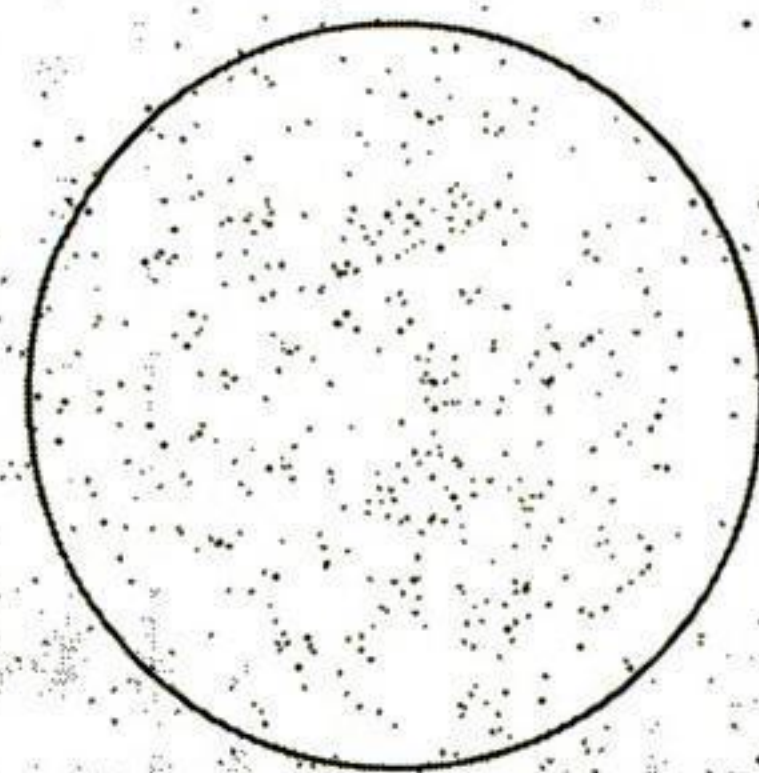
later a pioneer film maker, John Carbutt, produced a superior emulsion and supplied the experimenter with a boxful. During a thunderstorm on a September evening in 1882, Jennings made his first successful lightning picture. Showing an irregular branching discharge with nothing of the zigzag form, it created a sensation in scientific circles. Other striking views, widely published in scientific journals, followed in rapid succession. Experts regard Jennings's pictures as outstanding contributions to present-day knowledge of lightning, and formal recognition of his work came recently when the Franklin Institute in Philadelphia honored him with one of its most coveted medals.

New Shotgun Shell Aids Skeet Shooters



Crimped shell and, at right, an ordinary shell. The new type has no top wadding to push a hole in the shot pattern, as in the upper inset photo

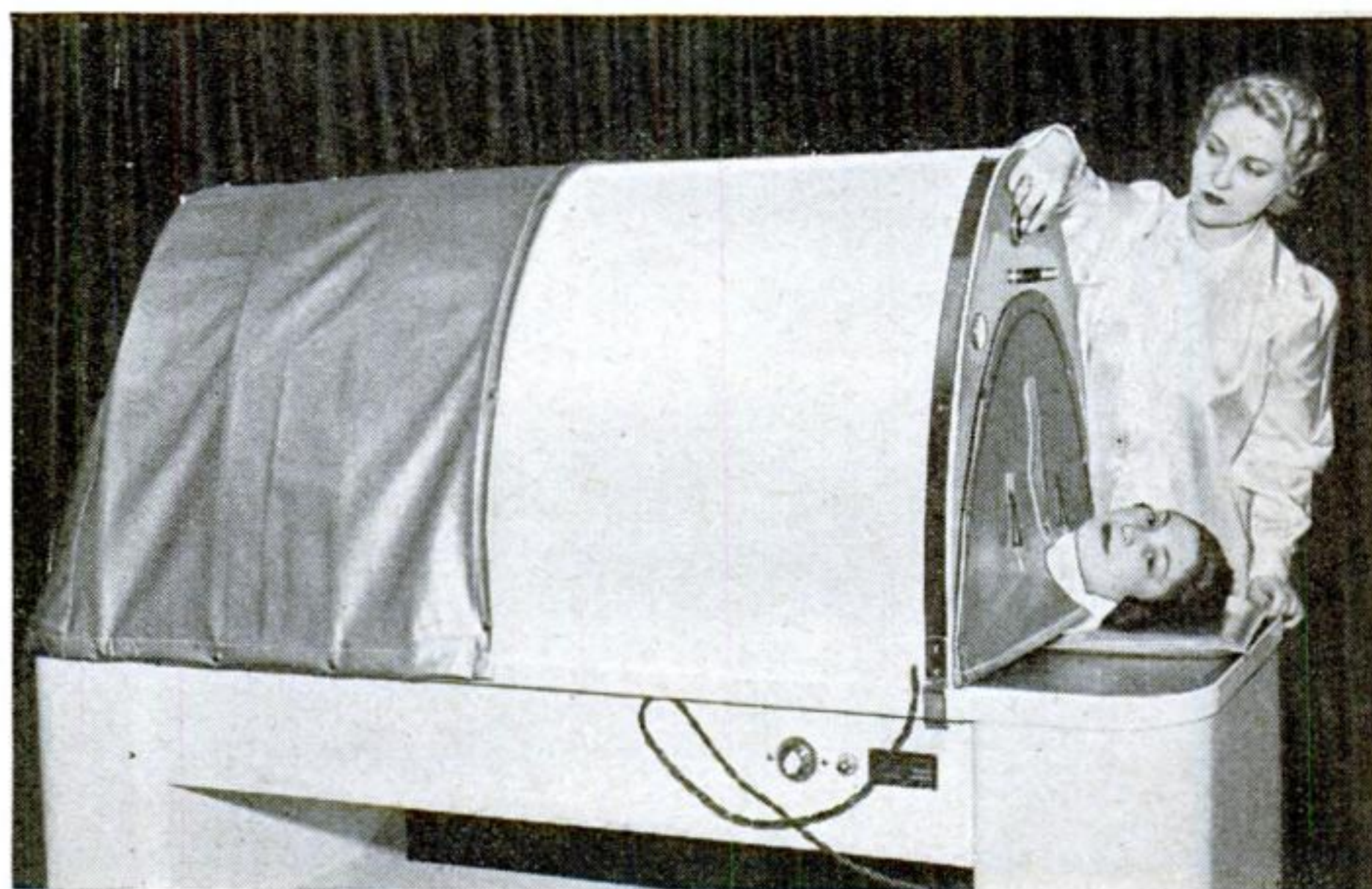
TRAPSHOOTERS and skeet enthusiasts should improve their scores with the use of a new shotgun shell that is said to eliminate the possibility of fired shot forming a "doughnut" pattern that could encircle a clay target without breaking it. High-speed photographs like the two at the upper right, taken by the light of a 1/1,000,000-second spark, proved that the top wad at the end of conventional shells occasionally interferes with the charge, causing the inefficient "doughnut" shot pattern. The new shells have no top wad, the open shell mouth being crimped together by a special machine to confine the shot. When fired, the shell mouth unfolds, leaving nothing to obstruct the charge.



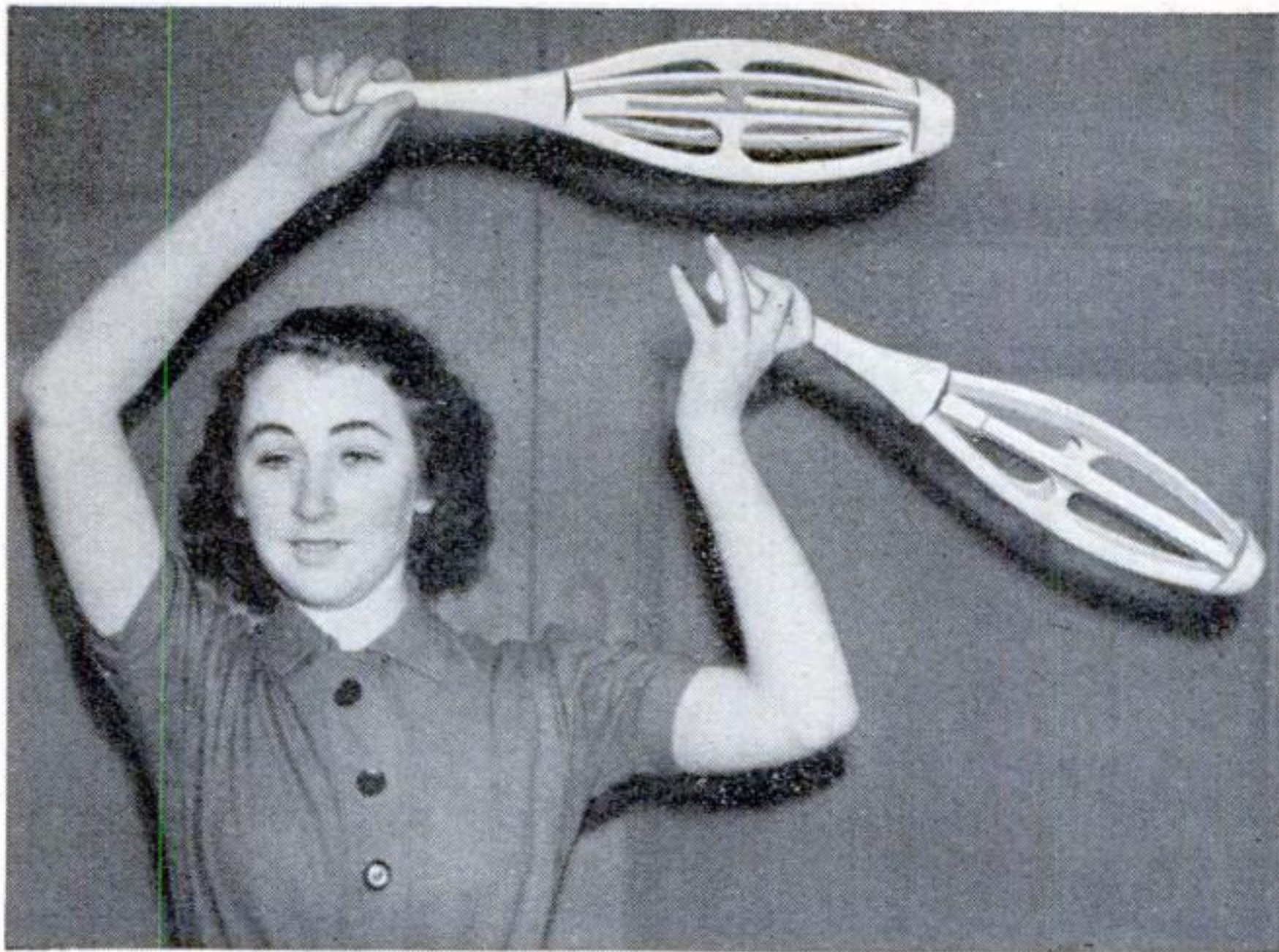
Note the uniform target pattern made by the undispersed pellets fired from the new shell

Beautifier Treats the Whole Body

HEAD-TO-TOE beauty treatments are administered by the telescoping electric cabinet shown in use at the right. With all but her head inside of the cabinet, the beauty-shop patron is given a vapor bath and subjected to a flood of infra-red rays from interior lamps at the same time. The cabinet can be made smaller to give local treatments to any part of the body, while exposed parts are being massaged by a beauty-shop attendant.



The whole body is treated at once in the telescoping beauty cabinet



With weights removed, the clubs are light and easy to swing

Indian Clubs Have Removable Weights

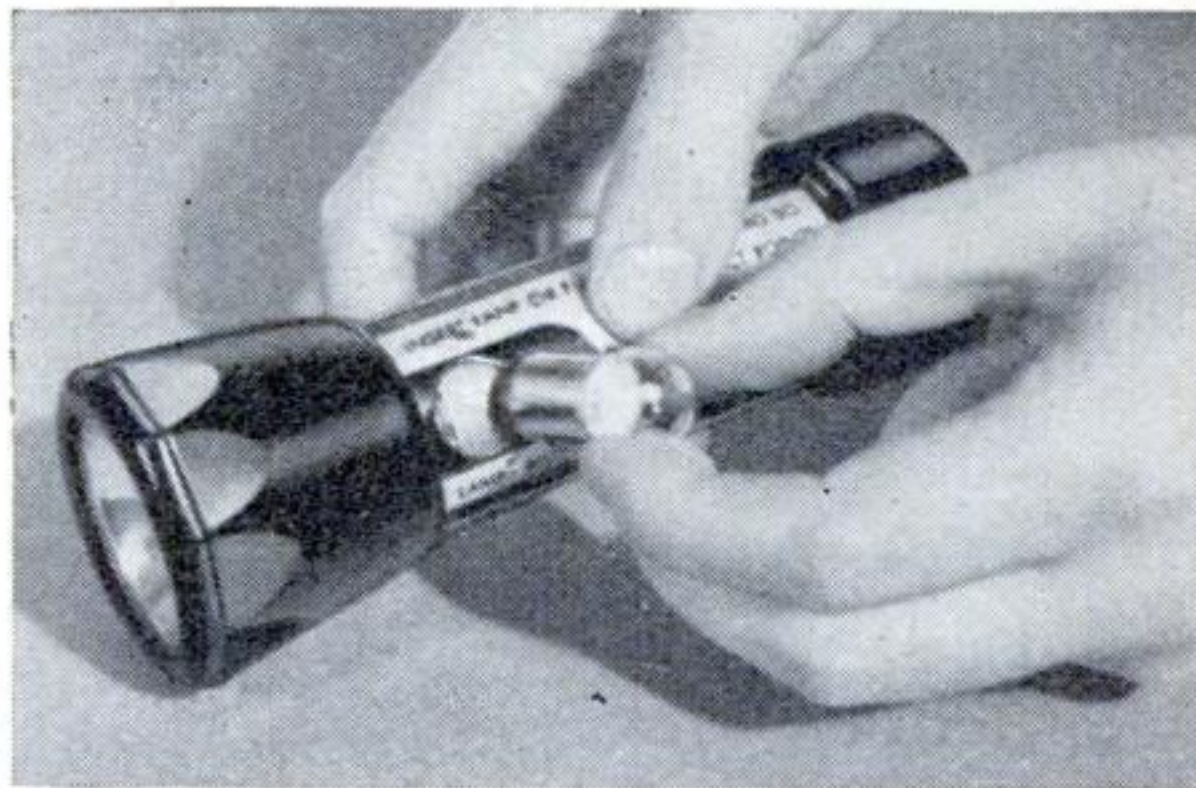
INDIAN CLUBS for gymnastic exercises, constructed so that their weight and balance may be adjusted to suit the user, have been developed by Hamlet Walton, of Sheffield, England. The clubs are made with skeleton-framework bodies consisting of a group of open vanes whose inner edges form a cylindrical central compartment into which weights ranging from five to fifty-eight ounces may be inserted. The novel clubs are pictured at the left in use by a demonstrator at an exhibition of recent inventions, held in London.

All set for "Action, lights, camera!" This home-movie fan built his own camera dolly



Home-Movie-Camera Dolly Built from Junk Parts

ROLLING smoothly on four doughnut-type tires, a homemade camera dolly built by Lester A. Weiss, Kalamazoo, Mich., home-movie enthusiast, was constructed mainly from scrap material. Seat, camera support, and light standards were adapted from various junk-yard parts, including an automobile real-axle housing, a discarded piano stool, and some odd lengths of old pipe. The dolly weighs between 100 and 150 pounds, and is wired for electric lights.

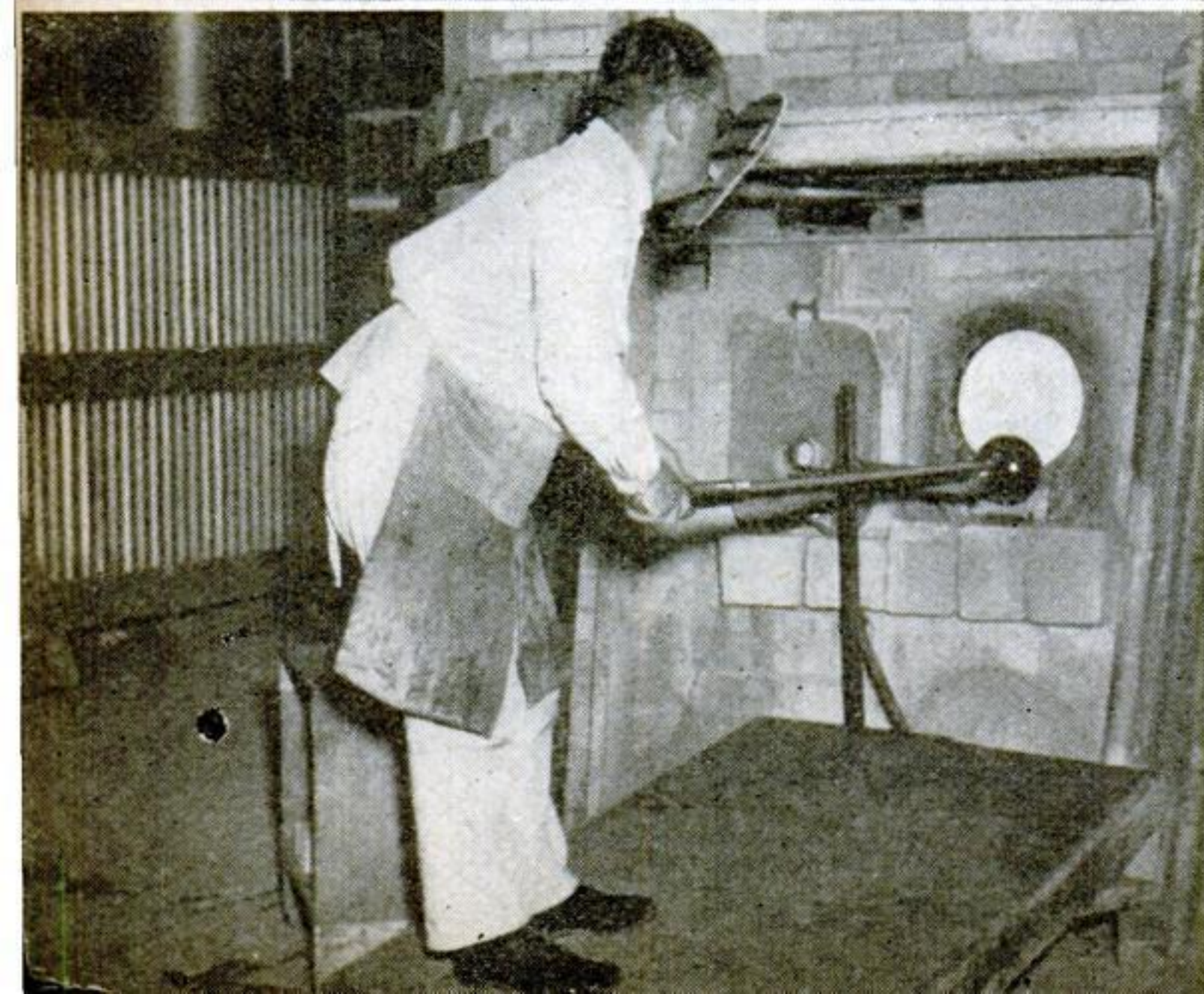
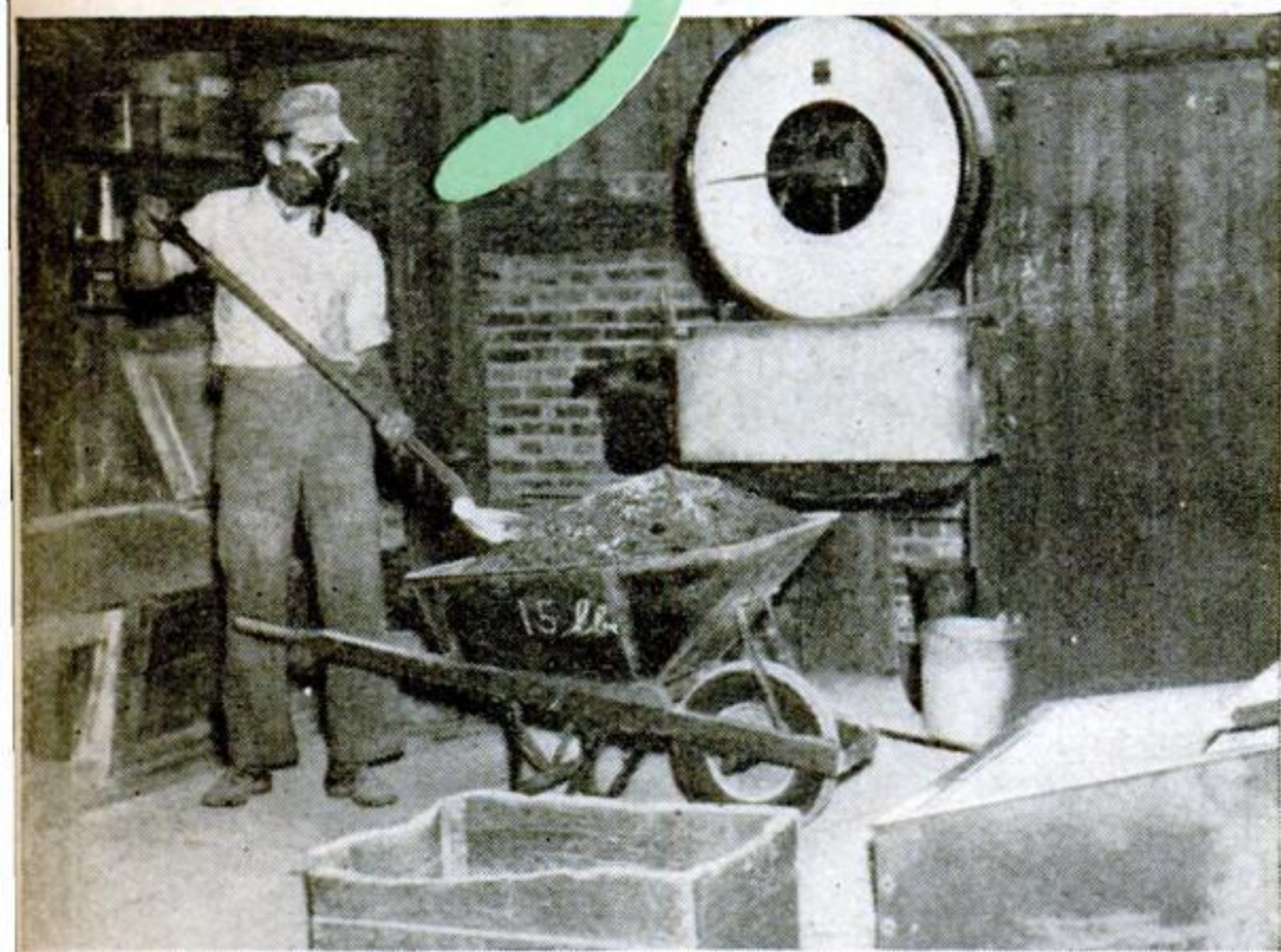


Flash Light Tests Bulbs and Fuses

FUSES and light bulbs for automobiles are easily tested with a novel flash light now on the market. A fuse or bulb is placed in a special socket in the side of the flash-light case. If it is good, it will complete a circuit and light the flash-light bulb. The tester has a waterproof body, with head and base of rubber to prevent breakage.



Sun



THE craze for gayly colored sun glasses that swept the country last year and is booming again with even greater fervor as summer comes on again, has revived to full capacity one of the most remarkable and least-known branches of the glass-making industry. Although tens of thousands of the familiar "smoked" and amber glasses, for beach and sporting wear, had been made and sold regularly each year, the new fad sent the demand skyrocketing to millions, while lens glass of half a dozen new tints and colors had to be created almost overnight.

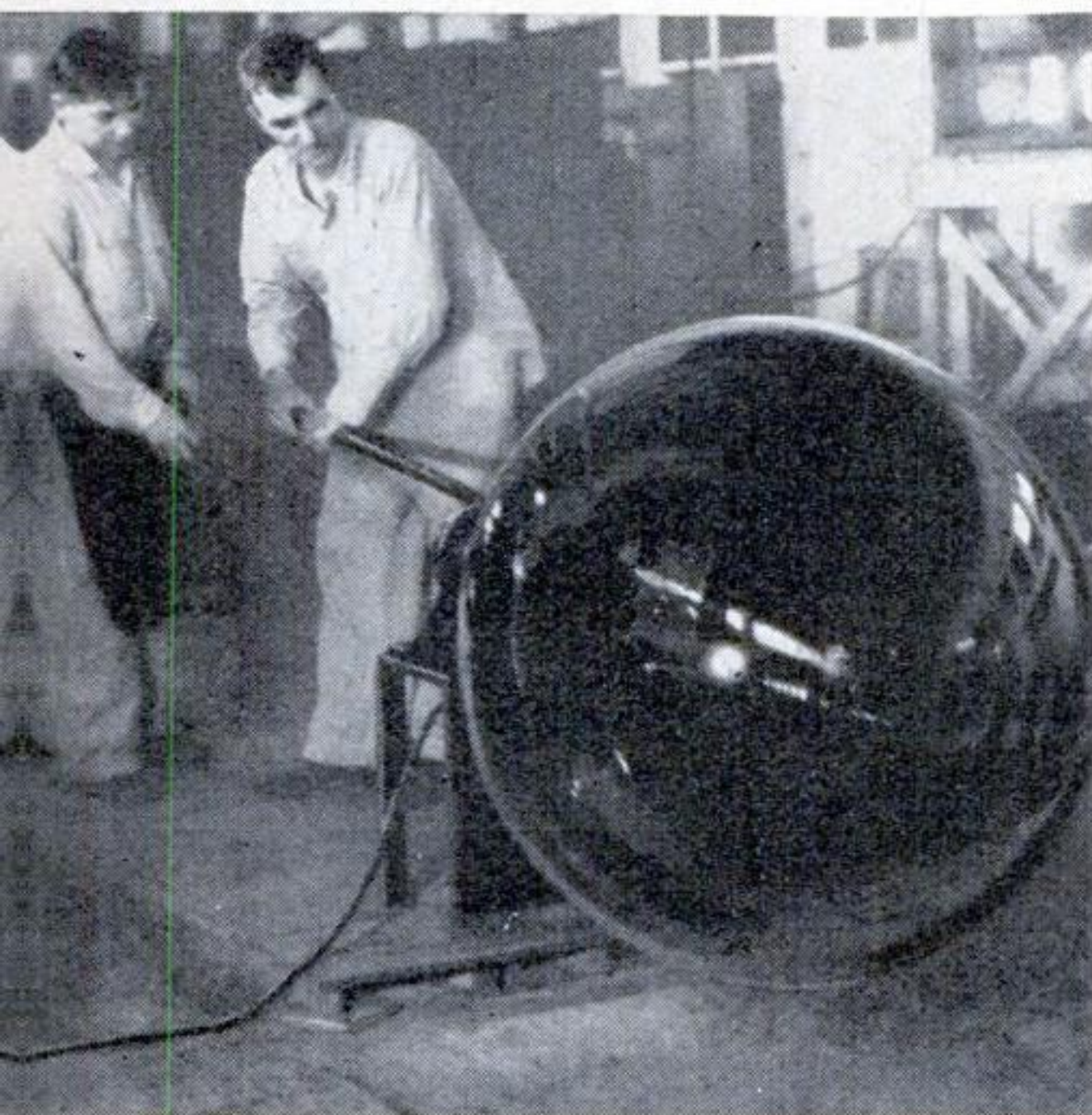
How could millions of colored convex glass lenses be made finely enough, quickly enough, and cheaply enough to meet this challenge? Grinding was far too expensive and slow, and molding too crude. The only way out lay in making huge "goggle

How Bubbles of Tinted Glass Bring Comfort to Your Eyes

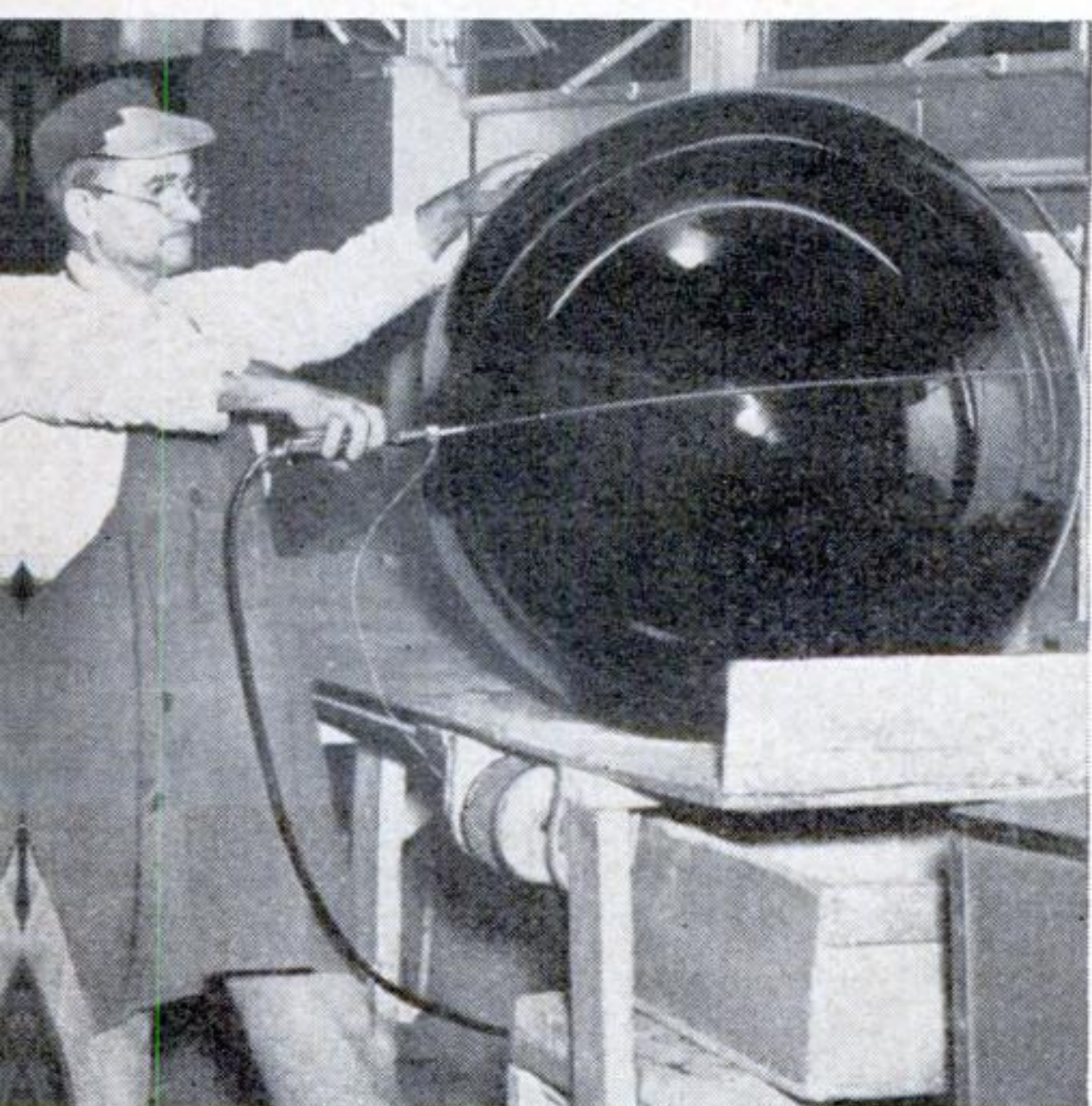
The first step in making sun glasses is to mix the raw materials. In the upper picture a workman is weighing silica, lead oxide, pigment, and other ingredients for a "batch." When this has been melted in an open-pot furnace, a workman dips a blowpipe in the white-hot mass



After gathering a ball of molten glass, he blows it into a bubble, rotating it constantly to keep it even



To complete the blowing, an air hose is connected to the pipe, supplementing the workman's lung power

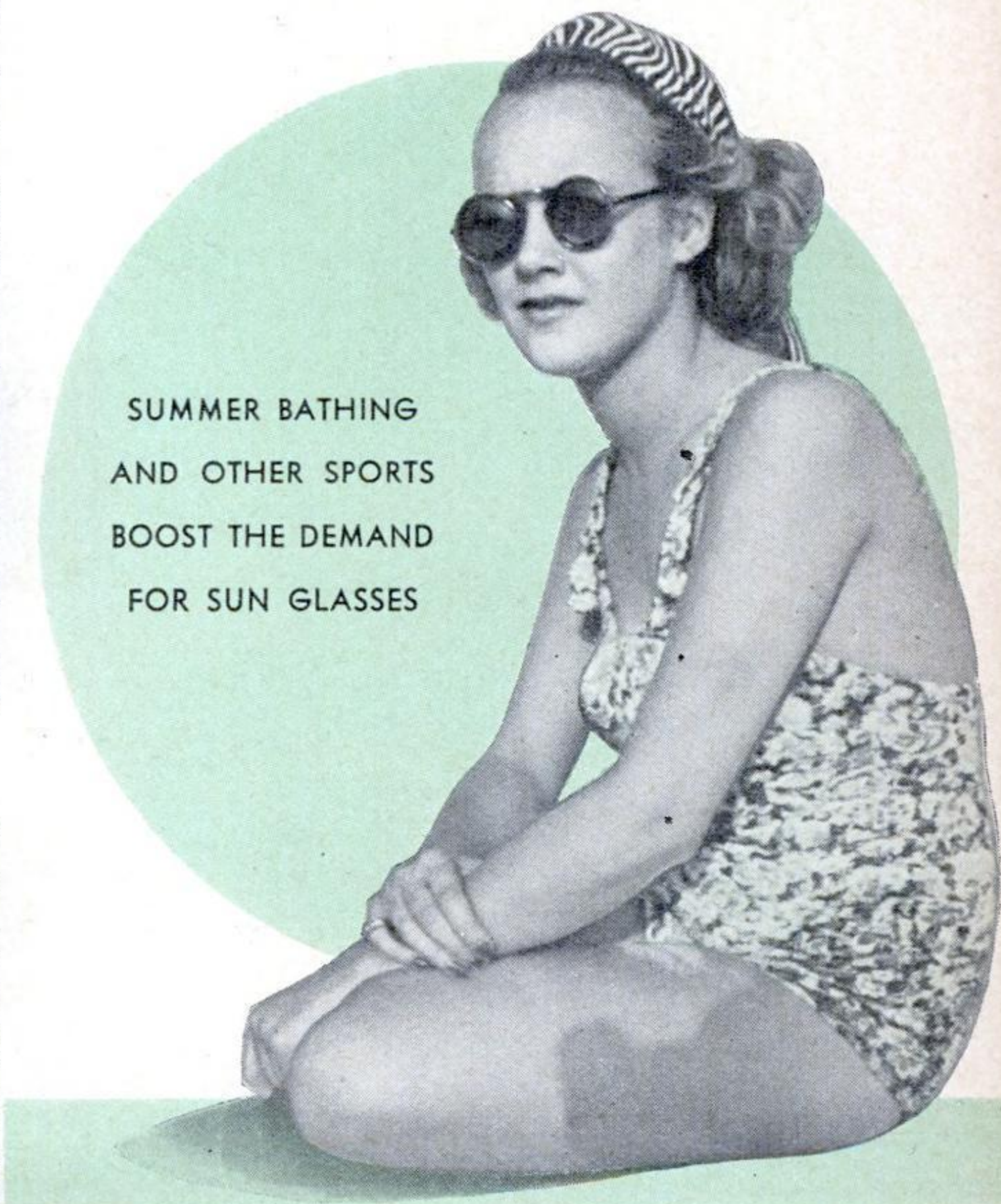


After the ball has cooled, a loop of wire is placed around it and a current of electricity is passed through the wire. Heat cracks the glass and the bubble falls apart in two halves to be scored with diamonds as seen at the right

balls," fantastic bubbles of blown glass, polished by fire and later cut by means of heated electric wires and diamonds into the small convex disks and other shapes required for lenses.

Leon J. Houze, a master glass worker from Belgium, started the goggle-ball business in this country during the World War, when the importation of colored glass for eye protection became impossible. Beginning with amber, he later developed blue, green, flint (a yellow-green glass for absorbing ultra-violet light), smoke, and many special tints for sun glasses and welding goggles. Soon, the Houze company supplied lenses of any required color to the United States Navy and to almost all the industrial goggle and sun-glass makers in America. Needless to say, these manufacturers turned straightway to Houze to solve their lens

SUMMER BATHING
AND OTHER SPORTS
BOOST THE DEMAND
FOR SUN GLASSES





Girls operate rotary scoring machines to mark out round or elliptical shapes in the large slabs taken from the half spheres. Now the lenses are completed

At the left, girls are inserting lenses in heated frames. As the frames cool and contract, they grip the glass firmly. Glasses are now ready for wearing

problems in the sun-glass boom of last summer.

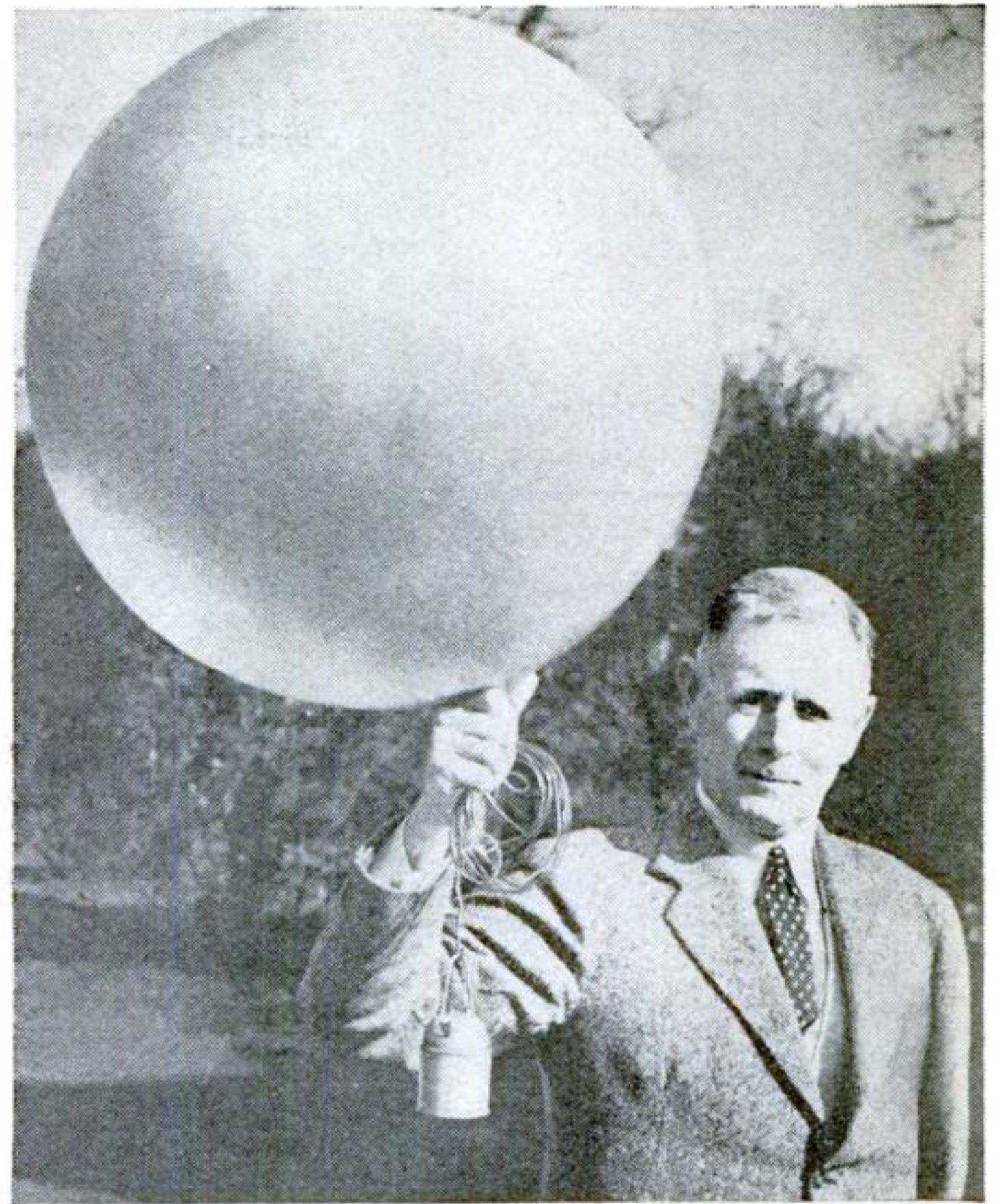
The accompanying photographs, published for the first time in a popular magazine, were all taken in the factory at Point Marion, Pa., where nine out of ten of the lenses in the millions of pairs of goggles in use in this country today were made. They show the amazing process, step by step, from crude material to finished glasses. The goggle balls, blown in the process, are nearly three feet in diameter, and are certainly among the largest pieces of mouth-blown glassware ever produced for any purpose.

Starting with a ball of white-hot, molten glass on the end of a blowpipe, a skilled glass blower puffs the tinted crystal into a

gleaming bubble, just as a child blows a sphere from soapy water. After a while, compressed air takes the place of human breath to blow the bubble up to its full size. Set out in rows to cool, the globes present a fantastic appearance. Sliced into halves by the electrically heated wires, they are further subdivided by cutting into curved plates with diamond tools. From these, girls cut lenses of the desired shapes with rotary scoring machines. The last stage of the process is to insert the lenses into heated frames. As the frames cool and contract, the lenses are gripped firmly. Curvature of the bubble walls gives the glass the desired convex shape, which could otherwise be obtained only by grinding or molding.

Aerial Mine Fields Planted with Balloons

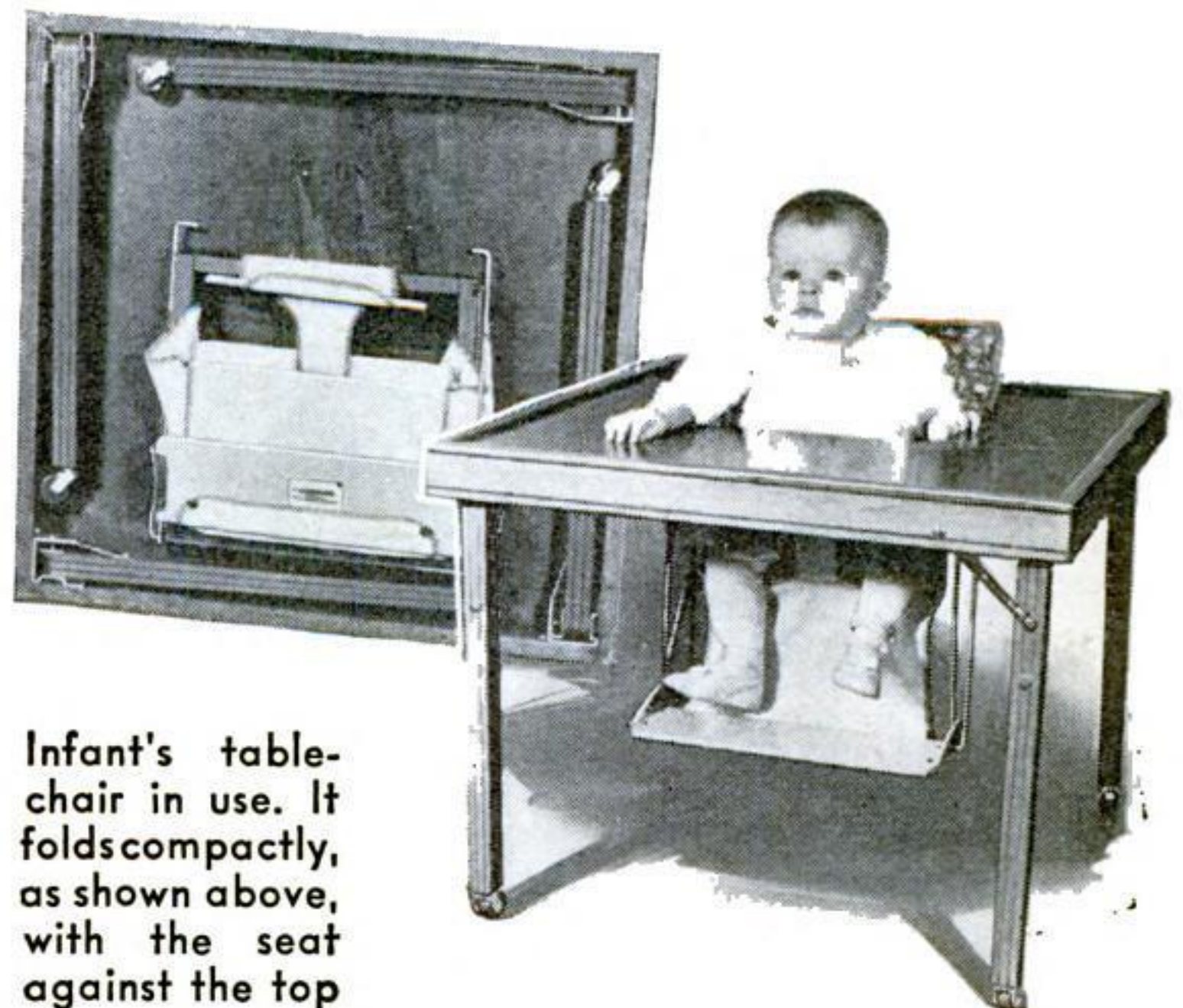
A FIELD of aerial mines, suspended from balloons floating over vital areas, would form an adequate means for defense against the wartime bombing raids of enemy airplanes, according to Major H. J. Muir, English inventor of a lightweight airplane mine. Attached to balloons by slender, forty-foot wires, groups of the eight-ounce mines would be "sown" in the air just as submarine mines are laid as a protection against enemy warships. Any plane striking a hanging mine would cause it to explode, crippling the invading ship.



Major H. J. Muir with one of his balloon aerial mines

Baby's Chair and Table in One Folding Unit

FOLDING into small space like an ordinary card table, a combined infant's chair and table is a useful addition to nursery furniture. The cushioned, collapsible seat rests out of the way beneath the table top when not in use. When needed, it opens up through a hole in the top. Safety straps hold the infant securely in place so it can't wriggle out above or under the table.



Infant's table-chair in use. It folds compactly, as shown above, with the seat against the top

Odd Eye Camera Locates "Punch" in Advertising

RECORDING the movements of the human eye while reading, a novel eye camera is being used to aid advertisers in planning and writing the text of advertisements. As he scans a test advertisement, the subject's head is held in a fixed position. Beams of light reflected from the eyes are then focused on two strips of film, one moving in a horizontal and the other in a vertical plane. When the developed films are projected onto the advertisement, spots of light move over the text, revealing the exact path taken by the reader's eyes, how long they lingered over any word or phrase, and other facts that may help copy writers to compose effective, easy-to-read advertising text that will pack the maximum "punch" in every line.

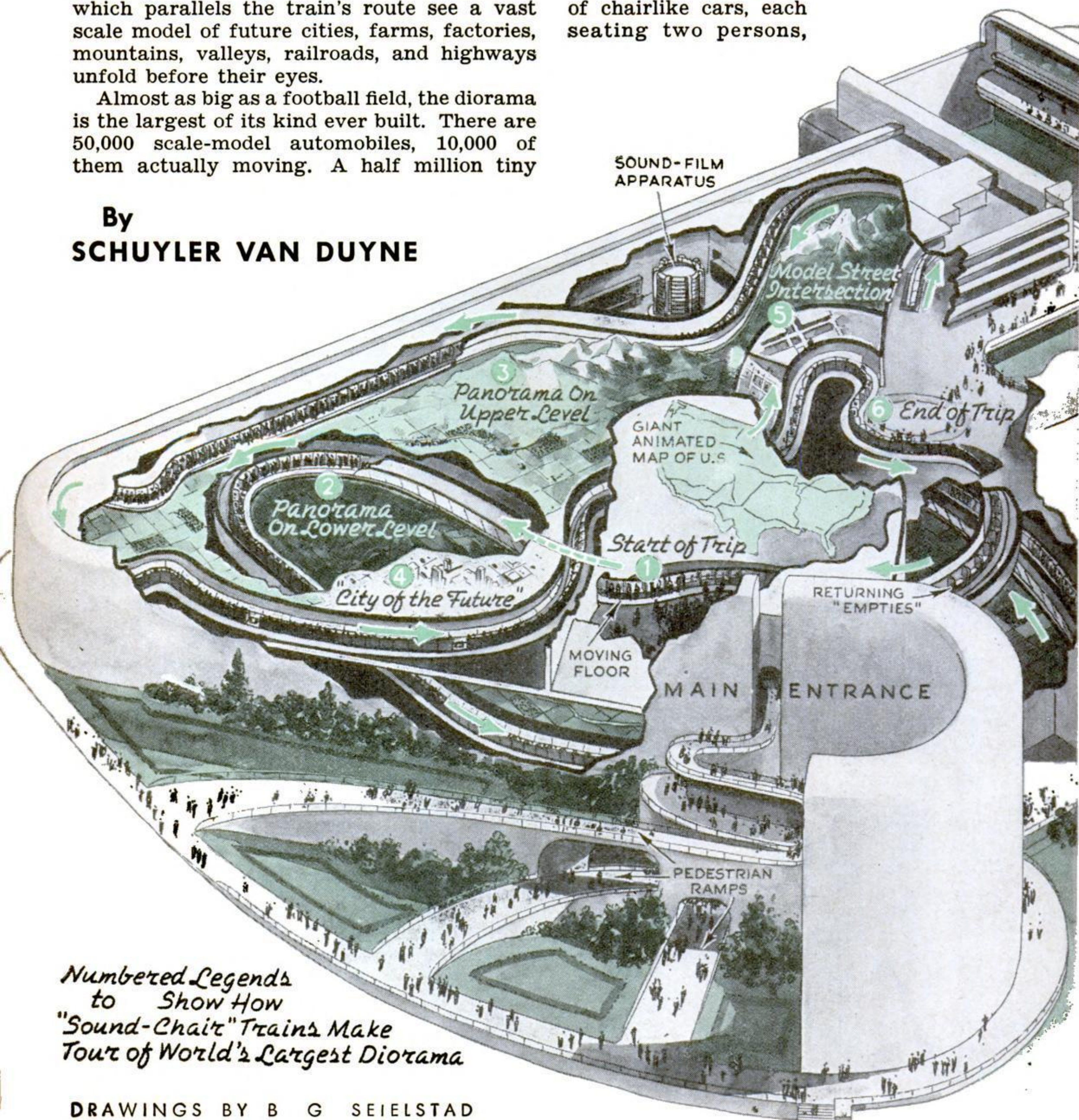
RIDING a twentieth-century, sound-equipped "magic carpet" across a miniature America of the year 1960! That is the daily experience of thousands of visitors to the General Motors exhibit at the New York World's Fair. Comfortably seated in chairs that form an endless, 300-car train, 600 passengers looking through a long window which parallels the train's route see a vast scale model of future cities, farms, factories, mountains, valleys, railroads, and highways unfold before their eyes.

Almost as big as a football field, the diorama is the largest of its kind ever built. There are 50,000 scale-model automobiles, 10,000 of them actually moving. A half million tiny

buildings comprise its many cities and villages. Snow-covered mountains are crossed, and deep ravines explored, before the spectators come to the end of the preview of what the nation's "Highways and Horizons," as the spectacle is named, may well look like twenty years from today.

As the endless chain of chairlike cars, each seating two persons,

By
SCHUYLER VAN DUYNE

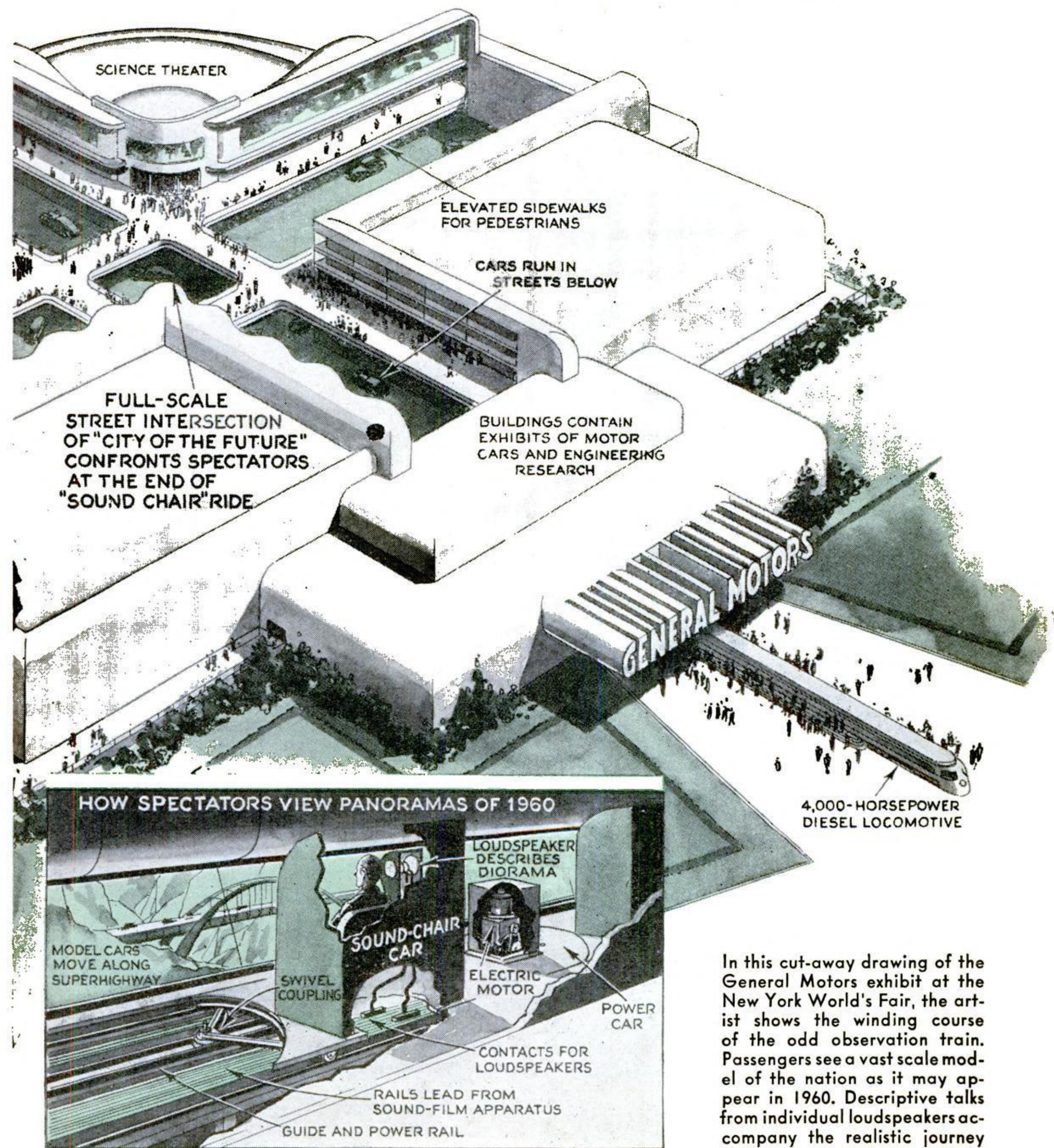


*Numbered Legends
to Show How
"Sound-Chair" Trains Make
Tour of World's Largest Diorama*

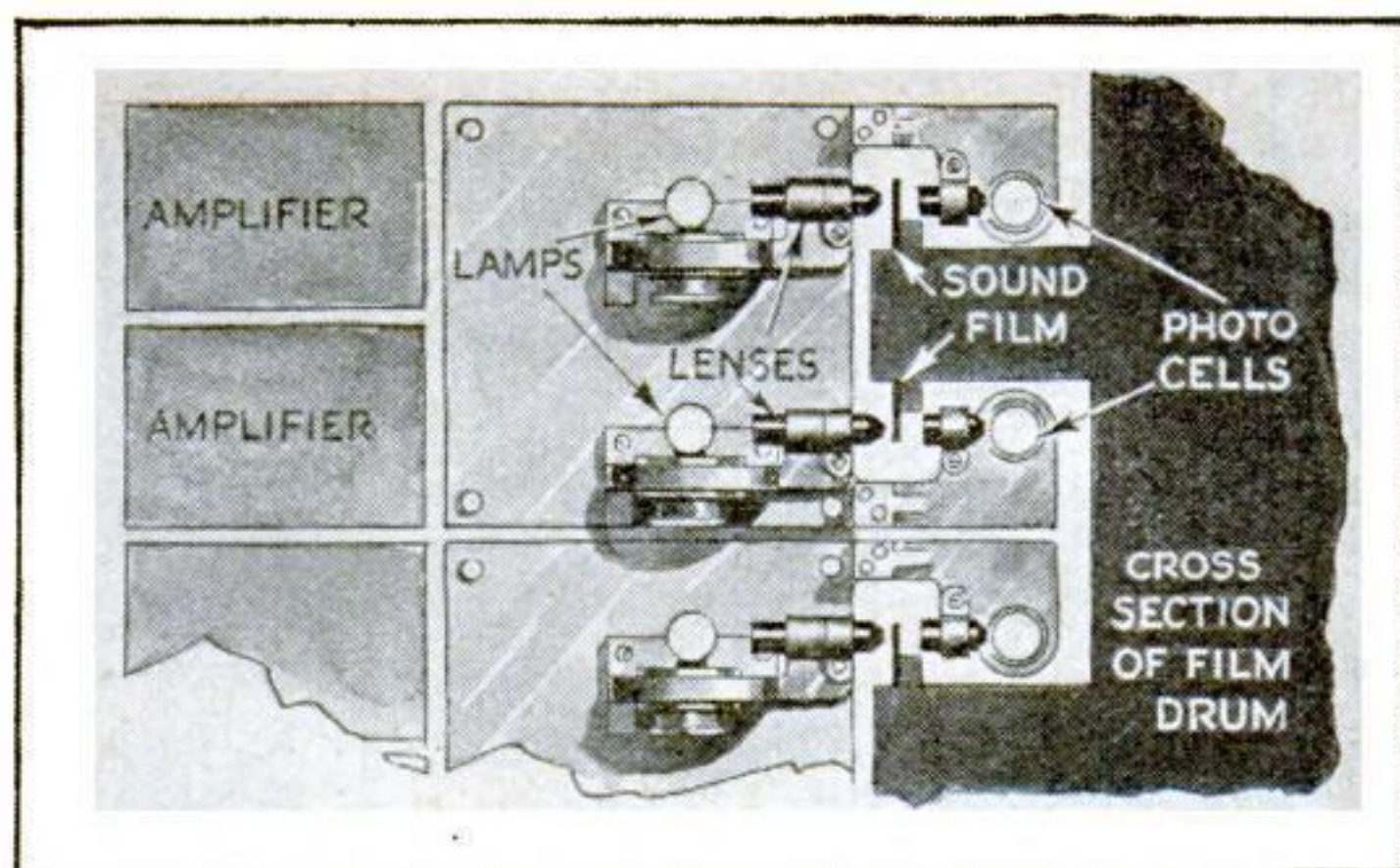
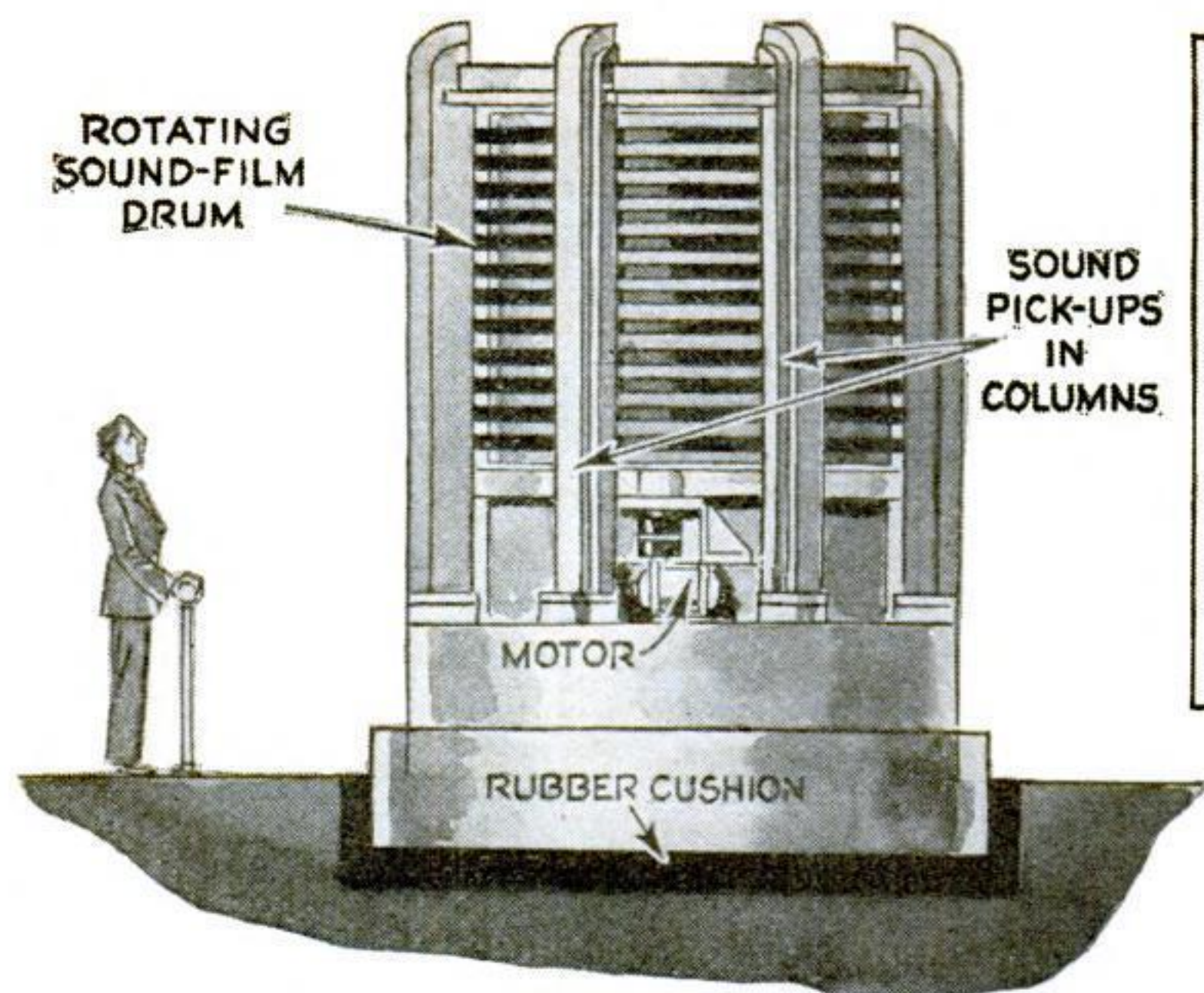
DRAWINGS BY B G SEIELSTAD

twists and winds through the air-conditioned passageway flanking the huge "futurama," loudspeakers built into the chair backs bring to the spectators a descriptive talk explaining the exhibit. To make this possible, expert

sound engineers were called in to develop and build one of the most complicated public-address systems ever devised. So sensitive is its twenty-ton sound mechanism that it had to be set in huge blocks of rubber to guard it from vibration, and virtually shut up in an



In this cut-away drawing of the General Motors exhibit at the New York World's Fair, the artist shows the winding course of the odd observation train. Passengers see a vast scale model of the nation as it may appear in 1960. Descriptive talks from individual loudspeakers accompany the realistic journey



From twelve sound films on the revolving drum, the 150 descriptive talks are picked up by light cells as shown in sketch above

air-conditioned vault to protect it from atmospheric changes.

Shaped like a cylindrical water tank, twice as tall as a man, a giant drum revolves slowly. As it turns, 150 "electric eyes" react to needles of light penetrating 150 sound-track films mounted on the drum. Each sound track, a separate recording of the talk describing the diorama, is synchronized to the movement of a group of four chairs and is transmitted to the built-in loudspeakers by an ingenious system of "third rails" and pick-up shoes beneath the cars. Thus, each spectator hears a running description of the

exhibit perfectly timed to the progress of the chair in which he is sitting. High backs and sides on the chairs prevent the sound from one group of loudspeakers from reaching the occupants of adjacent sets of chairs.

To make it easy for the visitors to board the moving cars, passengers first step onto a moving platform in the entrance rotunda of the building. From this, it is a simple matter to walk aboard a car and sit down. Presently, the chairs pass into a darkened passageway, and spectators find themselves looking through an inclined window out over a countryside in miniature. Then the loudspeakers in the chairs bring the "guide" voices, and the show is on.

Wheelbarrow Mixes Concrete

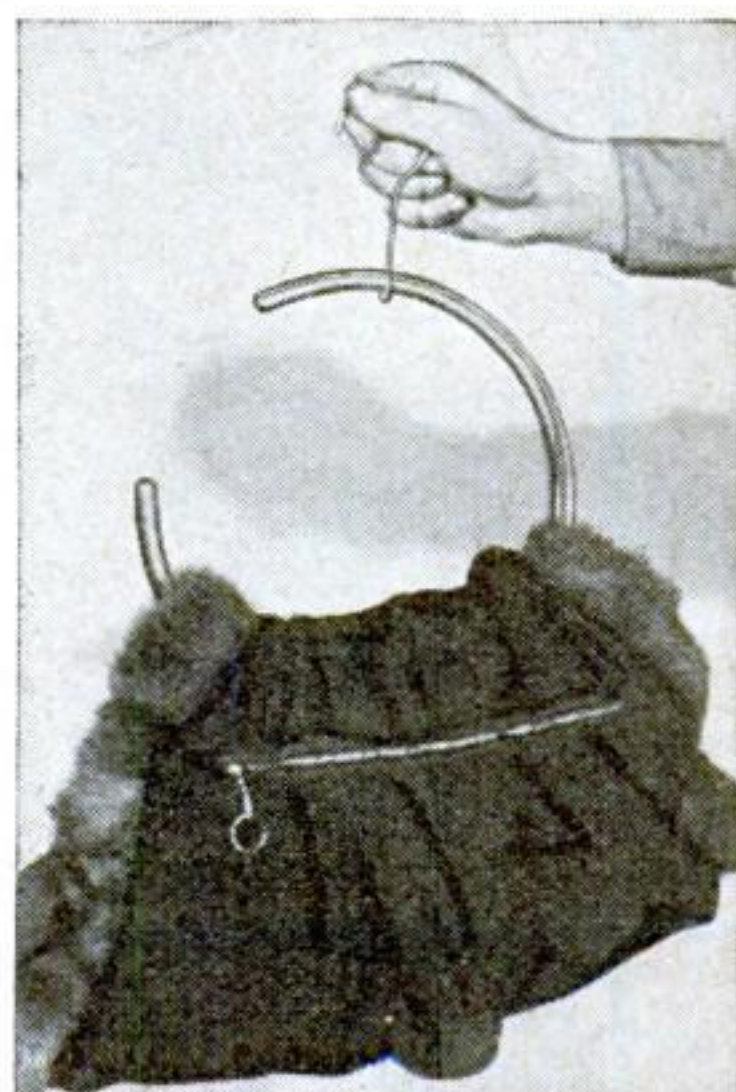
TIME and labor are saved on small construction jobs by a new wheelbarrow which mixes concrete as it is being wheeled to the spot where it is to be poured. Concrete ingredients in proper proportions are dumped into a drum mounted on the barrow. A sprocket chain geared to the barrow wheel revolves the drum around four inside paddles to mix the concrete in transit. Wheeling the mixing barrow a distance of forty or fifty feet is said to be sufficient to mix its contents thoroughly without undue strain on the workman.



Raising the handles dumps the concrete mixed in transit in the revolving drum

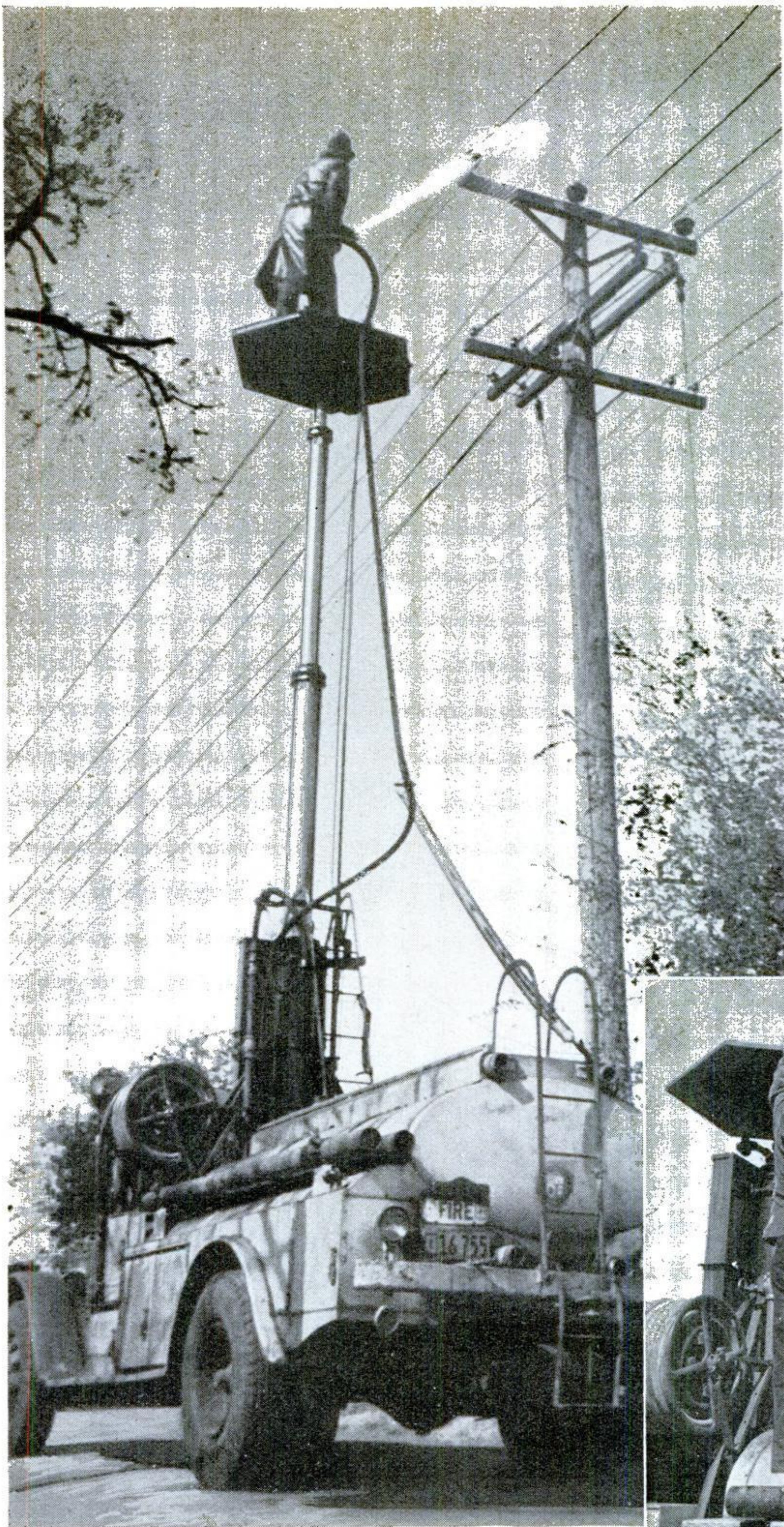
Hanger for Muff Is Space Saver

MADE of a new transparent plastic material, in the shape of a circle with a small segment removed, a novel hanger for use in closets is designed especially for fur muffs. Slipped through the circle opening, the muff is suspended on the curved lower section of the plastic bar, as shown in the photograph reproduced at the right.

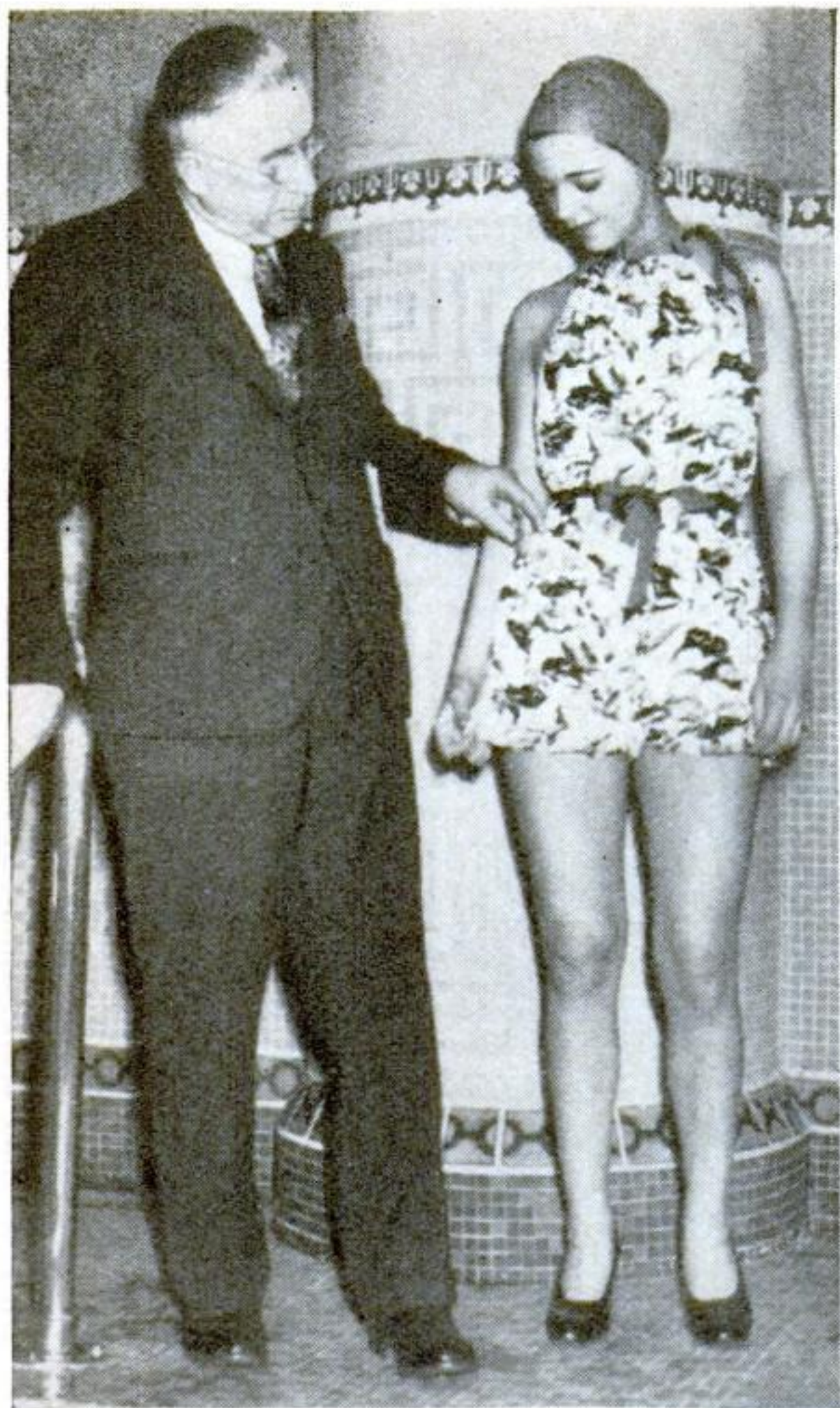


Firemen Use Telescoping Water Tower

PUSHED SKYWARD by a hydraulically operated, telescoping steel tower, a platform from which streams of water can be played directly onto the upper stories of buildings, is a novel feature of a fire engine now in use in southern California. As shown below, a fire fighter mounts the lowered platform, grabs a hose-line nozzle, and is then lifted to the required height. The heavy-duty vehicle has a 400-gallon water reservoir, and pressure pumps operated by the truck motor, for fighting fires at points remote from water-main hydrants. The tower truck also is used to clean power-line insulators.



When not fighting fires, the hydraulically raised tower assists linemen in washing electric insulators, as seen above



Bathing Suit Is Unsinkable

AN UNSINKABLE bathing suit that will keep its wearer afloat was demonstrated recently by its inventor, Albert L. Sommers, in a New York City hotel swimming pool. The life-preserver suit maintains its high buoyancy through the use of an inner filling of tiny air-filled celluloid capsules and a plant product that is eight times as light as cork. The photograph below demonstrates the suit's floating qualities.

Air-filled celluloid capsules and a buoyant plant fiber enable this suit to support a swimmer in the water, as demonstrated at right

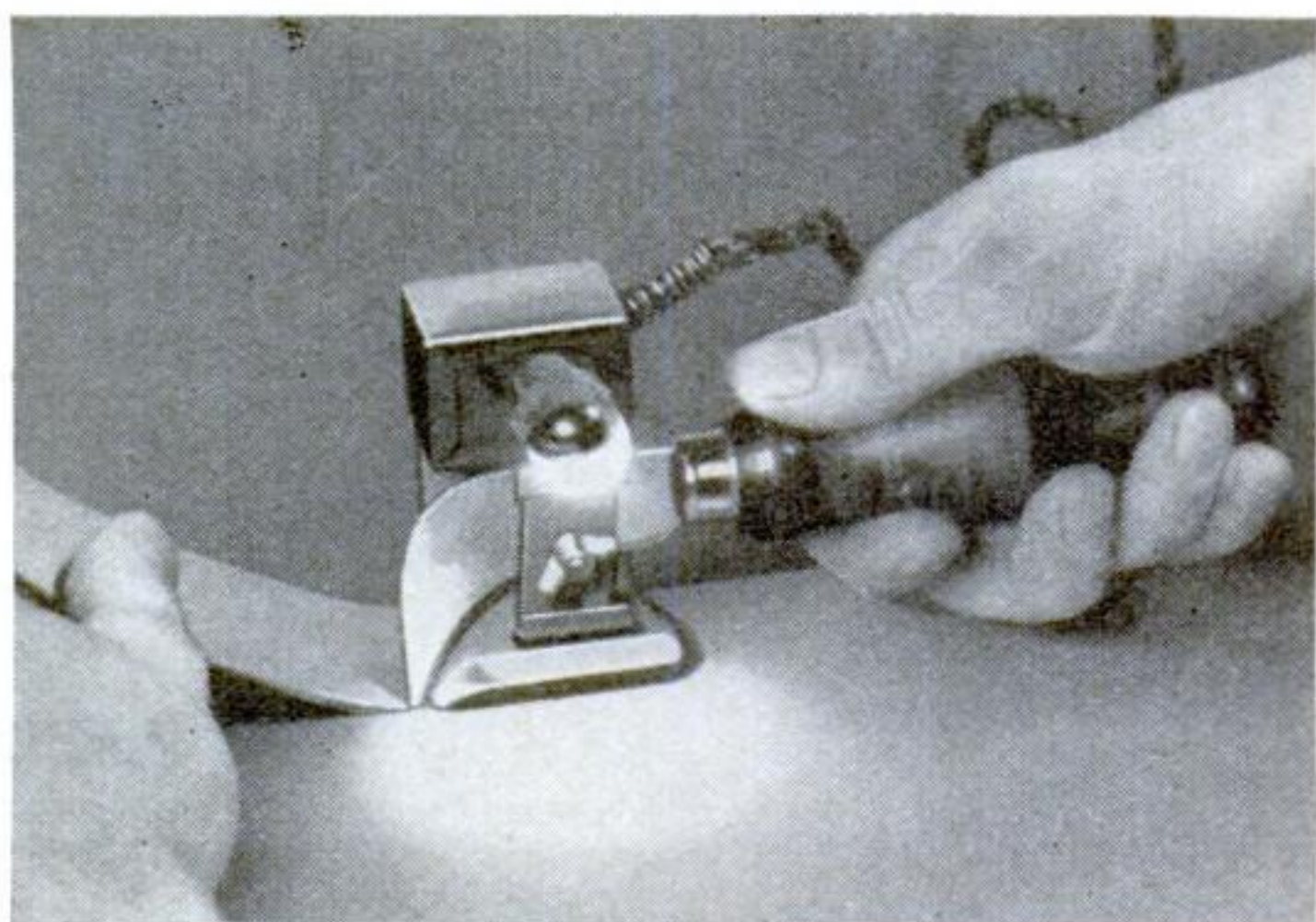


Electric Knife Sharpener

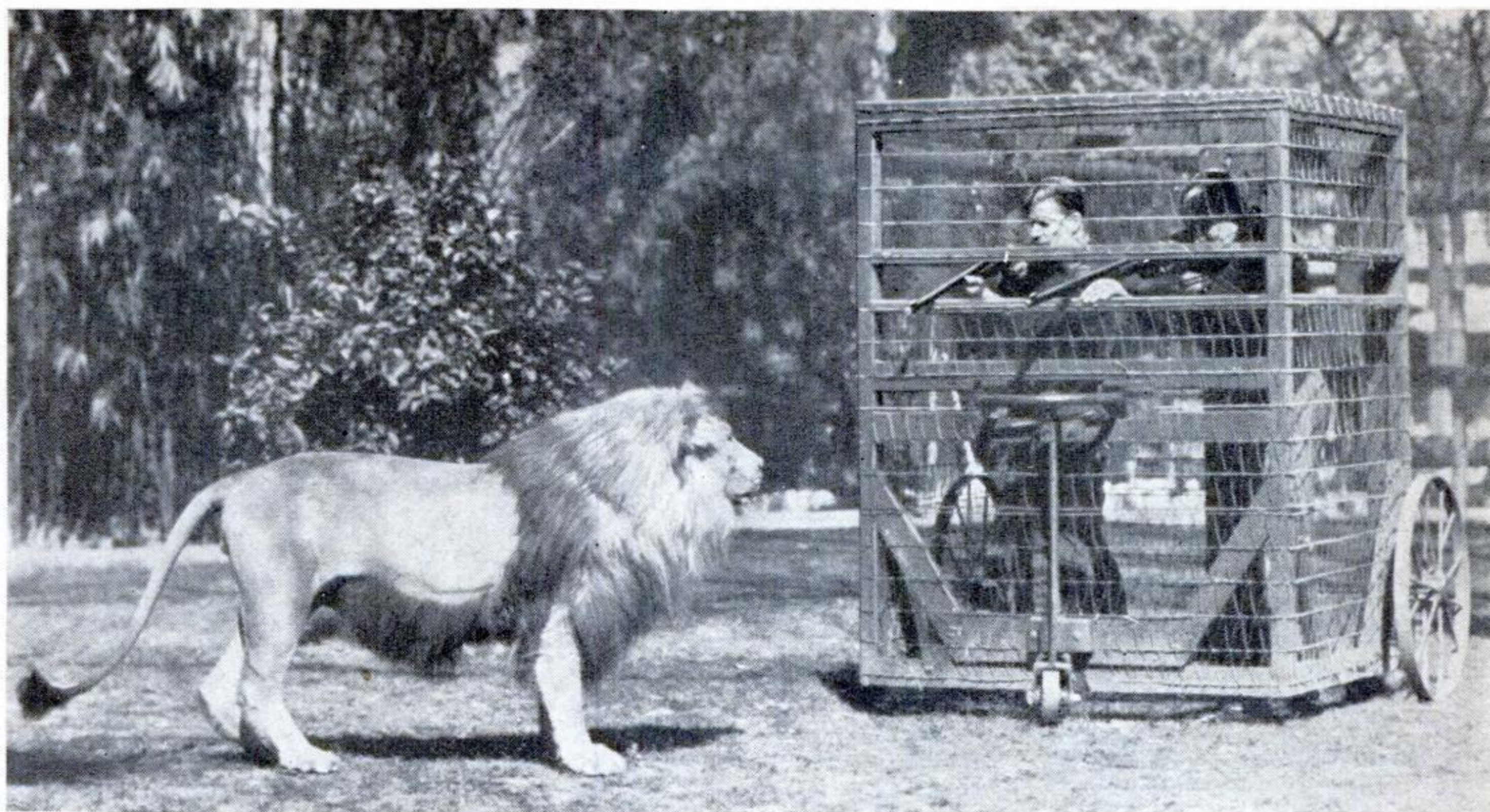
KNIFE blades of any size are quickly sharpened to a keen edge with a new electric grinder designed especially for use in meat markets, grocery stores, and restaurant kitchens. No skill is required to use the machine. The operator merely flips a switch and holds the blade in a slot, as pictured above.

Heated Linoleum Cutter Carries a Headlight

AN ELECTRIC heater which can be clamped to a standard linoleum knife softens the material by warming it, and allows the blade to slice through the linoleum easily and with little effort. A small light bulb and reflector which throw a concentrated beam onto the knife point are helpful in laying and cutting linoleum in badly lighted rooms.



Heat softens linoleum, and a light guides the blade



Walking Cage Protects Lion-Farm Guards

IT LOOKS as though the lion were the keeper, and the man the caged animal, in the photograph above, but the scene was really snapped on the world's only commercial lion farm, at El Monte, Calif., to picture the mobile cage designed to protect trainers who

may have to track down and kill any untamable beast that escapes from the confines of its pen. The floorless, three-wheeled cage has heavy wire protective netting mounted over a strong wood frame, with a gun slot to permit firing in any direction.

Basin for Shampooing Fits Any Customer

AN ADJUSTABLE washbasin with pipes arranged so that the fixture may be moved both vertically, and horizontally out from a wall, has just been introduced for barber and beauty-shop use. The basin has a curved lip shaped to fit the back of the neck, and can be adjusted to any height for the convenience of customers having their hair washed. It is shown in use in the illustration at the right.

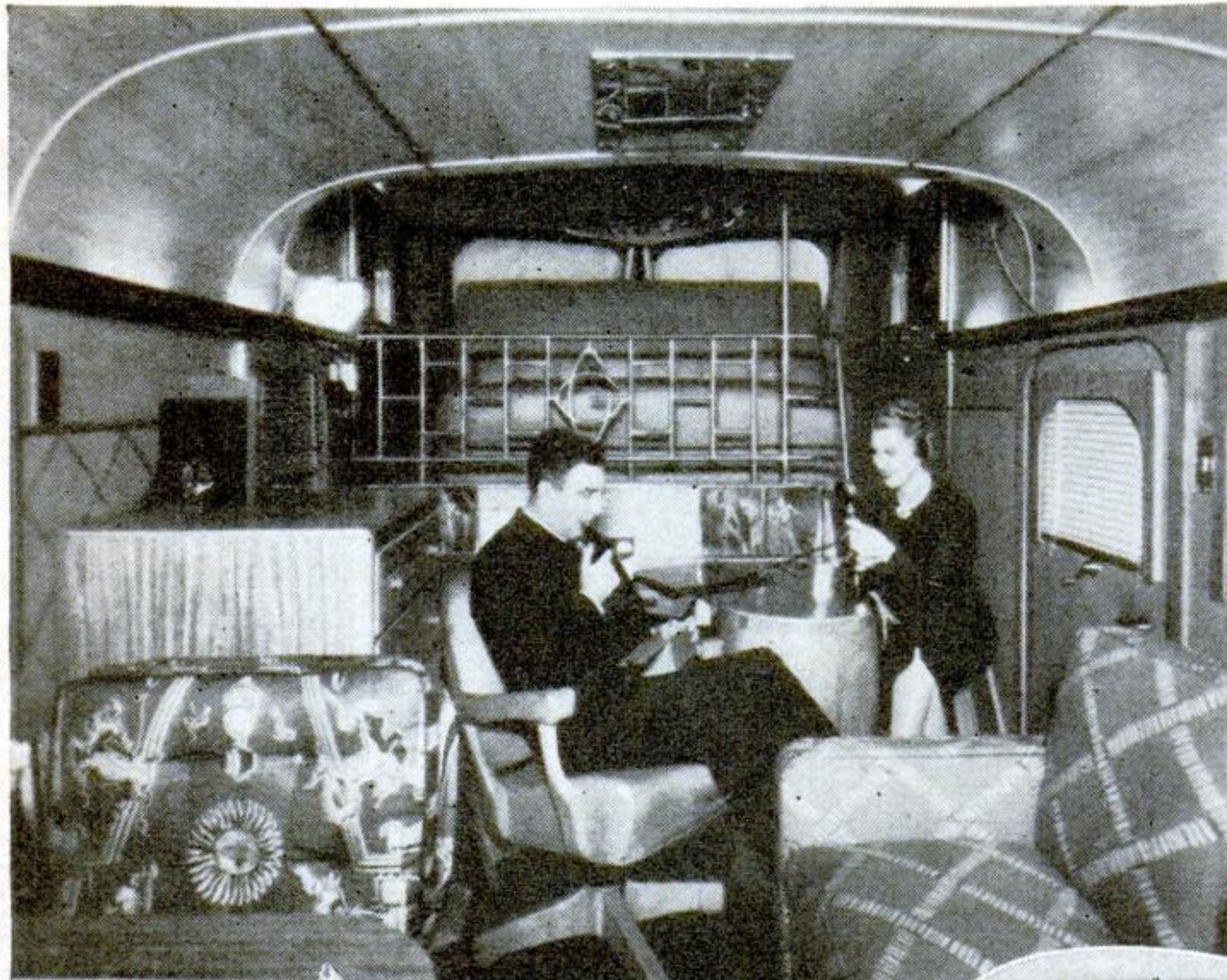
Planes Get More Speed with Flush Rivets

HIGHER speeds for airliners and war planes are foreseen through the use of flush rivets, instead of the projecting "button" type, to give a smooth-as-glass surface to wings and fuselages. It is estimated that a plane rated at 275 miles an hour with conventional rivets would be placed in the 300-mile-an-hour class if constructed with flush rivets.

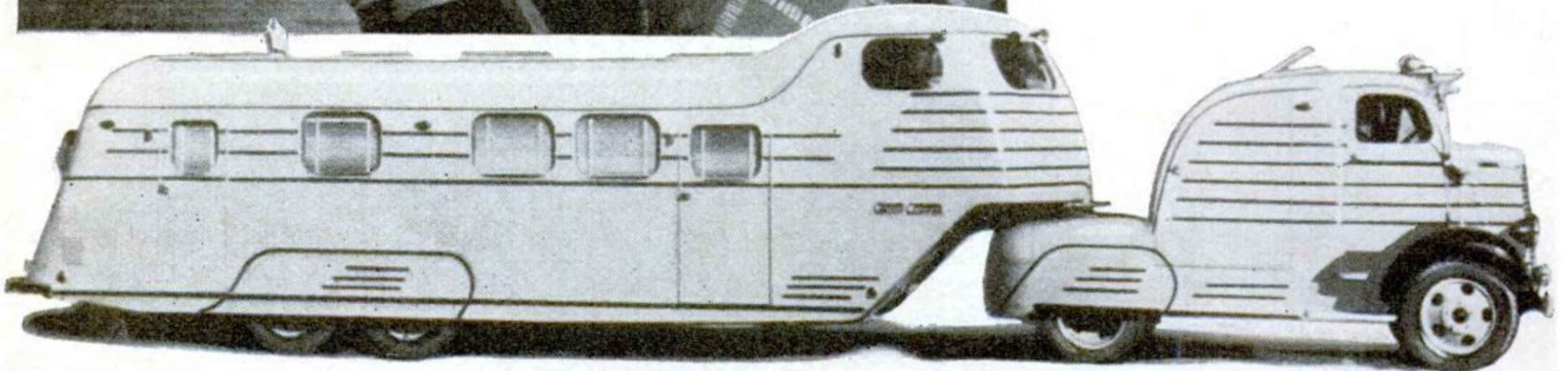


A curved lip on the adjustable basin supports the user's head

Trailer Combines Home and Office



HOME and office are combined in a custom-built trailer just completed for an executive whose business keeps him touring the country. Equipped with desks, typewriter, and electric dictating machine, it also provides the owner and his wife with satinwood-furnished living quarters, an upper-deck observation lounge, a tiled bathroom with hot and cold shower, and a stainless-steel kitchen with a range burning bottled gas. Telephones connect office, power car, and galley; and an air-conditioning plant maintains year-round comfort.



Interior and exterior views of the home and office on wheels. A 1 1/2-ton truck unit drags the huge trailer

New Adjustable Hospital Bed Turns into an Easy Chair

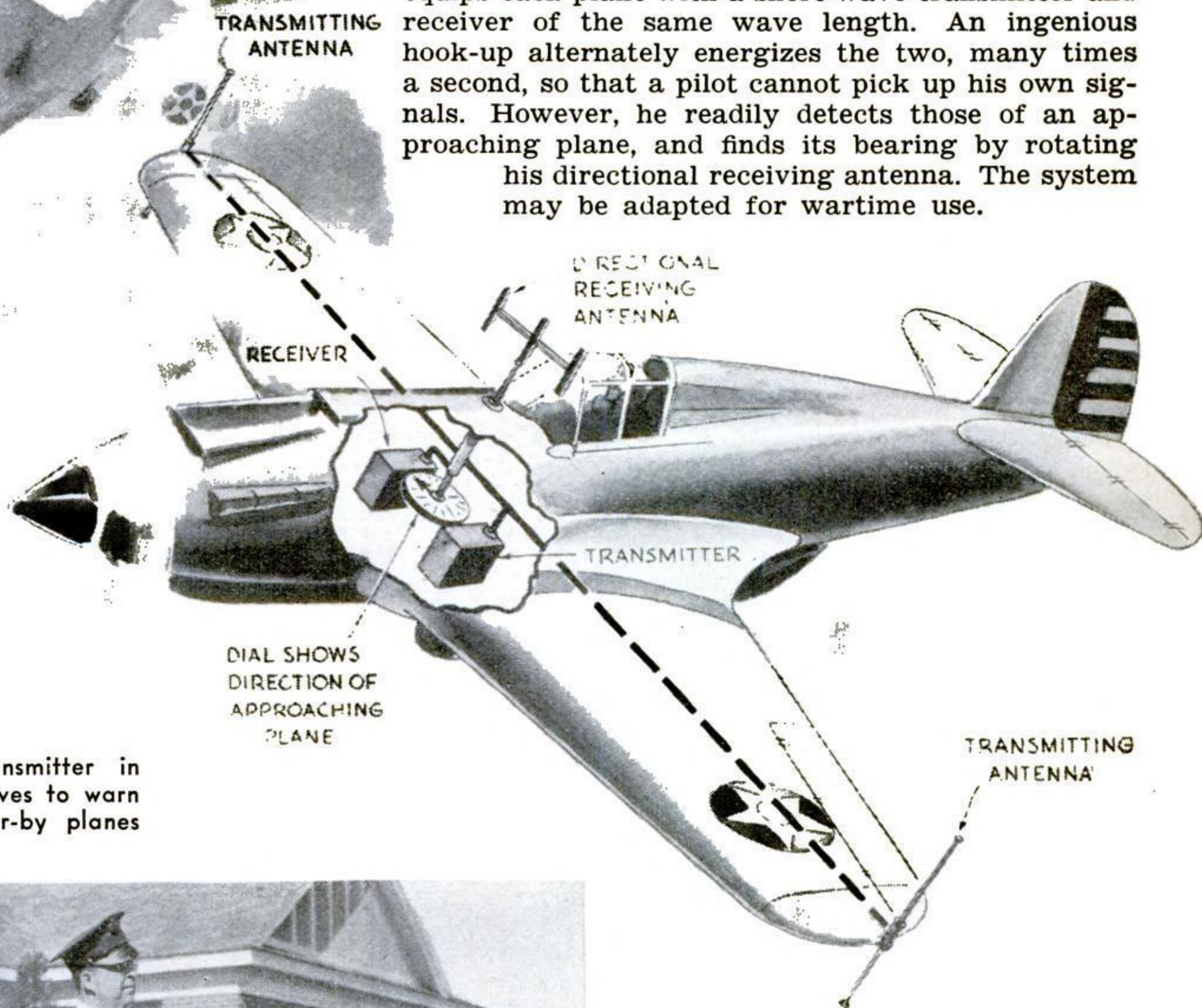
A BED that turns into an easy chair, through ingenious interaction of levers and supports, was recently placed on exhibition by its inventor at Boston, Mass. Designed for hospital use, the new model is declared to enable a patient to sit up and read or talk with visitors for an extended time without undue fatigue. By manipulating various levers, the bed may be adjusted to a variety of other positions as well. In the photograph at the right, a patient is shown resting in the bed after it has been adjusted to the position of an easy chair.



This is one of the positions to which the bed can be adjusted for the comfort of the patient

Radio System Prevents Airplane Collisions

TO AVERT plane collisions, a new radio system equips each plane with a short-wave transmitter and receiver of the same wave length. An ingenious hook-up alternately energizes the two, many times a second, so that a pilot cannot pick up his own signals. However, he readily detects those of an approaching plane, and finds its bearing by rotating his directional receiving antenna. The system may be adapted for wartime use.



A radio transmitter in each ship serves to warn pilots in near-by planes



Henry R. Smith, postman, aboard his homemade footstep saver

Postman Goes Around on Motor Scooter

MOTORIZED scooters for footsore mailmen are proposed by Henry R. Smith, letter carrier, of Columbia, S. C., who has constructed one of his own. The driver stands at the rear and steers with one hand, operating a combined clutch and brake control with the other. A gasoline motor drives the four-wheeled vehicle at four to twelve miles an hour. In tests, the scooter cut as much as two hours from the time required to cover an eight-mile route. Smith's machine cost him \$150 to build, but he estimates that mass production would cut the cost away down.

"I WILL always obey my superiors. I will never steal. I will never tell a lie. I will obey all the laws of my country, my state, and my city. I will always respect the Tri-State Detective Agency and protect it."

Thus runs the "Code of Conduct" of one of the most interesting and unusual organizations on earth, a boys' detective agency with

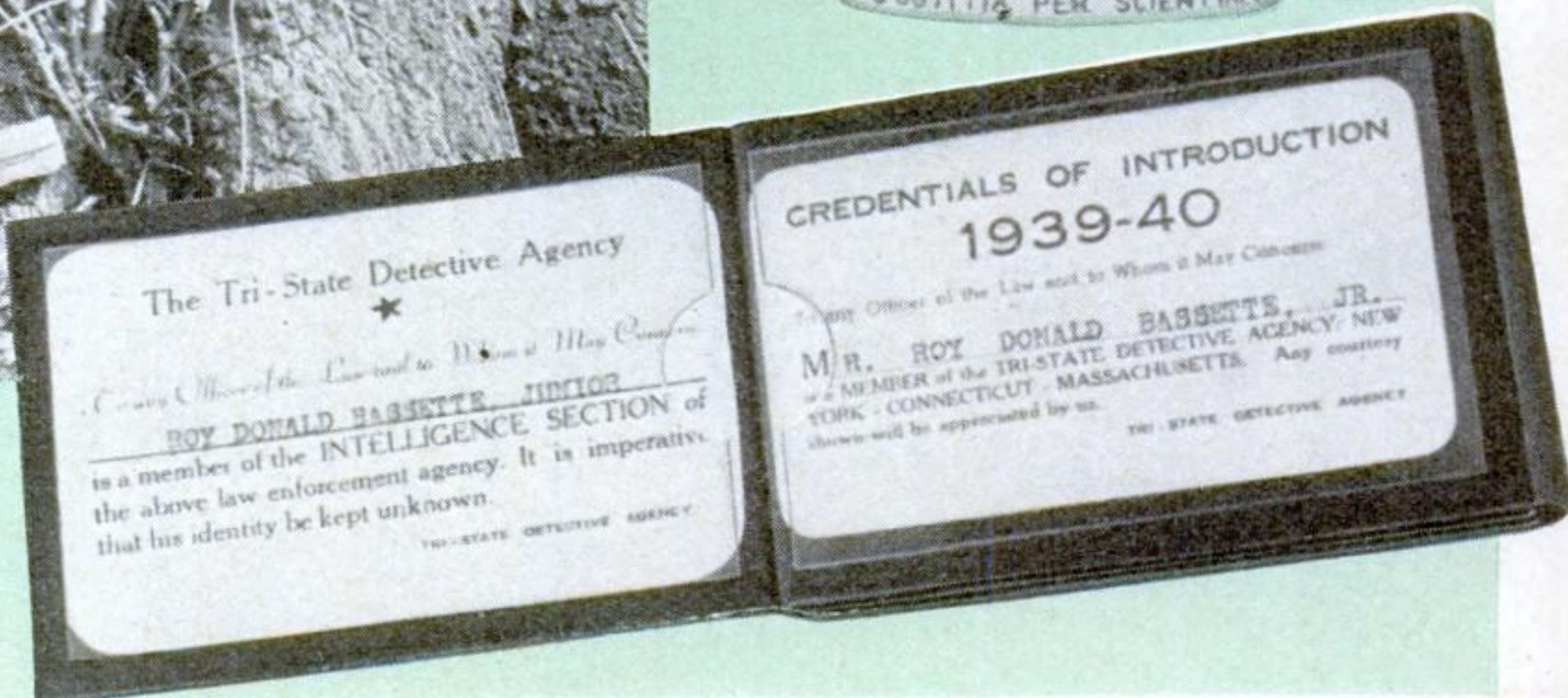
headquarters in the basement of a West Hartford, Conn., home and branches in various parts of the United States and Canada. Started a few years ago by four schoolboys, led by sixteen-year-old Roy D. Bassette, Jr., the organization now has an amazingly complete scientific crime-detection laboratory, a printing plant, a squad car, and an extensive library of criminological books and magazines. More than eighty-five boy detectives are members of the affiliated agencies.

So striking has been the success of the unique enterprise that visitors have flocked to the basement laboratory, hundreds of letters have been received, and J. Edgar Hoover, Director of the Federal Bureau of Investigation, recently invited young Bassette to come to Washington, D. C., as his guest.

By
IRWIN KOSTIN



Signs mark property protected by the unique boys' organization. Right, coat of arms of the agency and credentials of a member





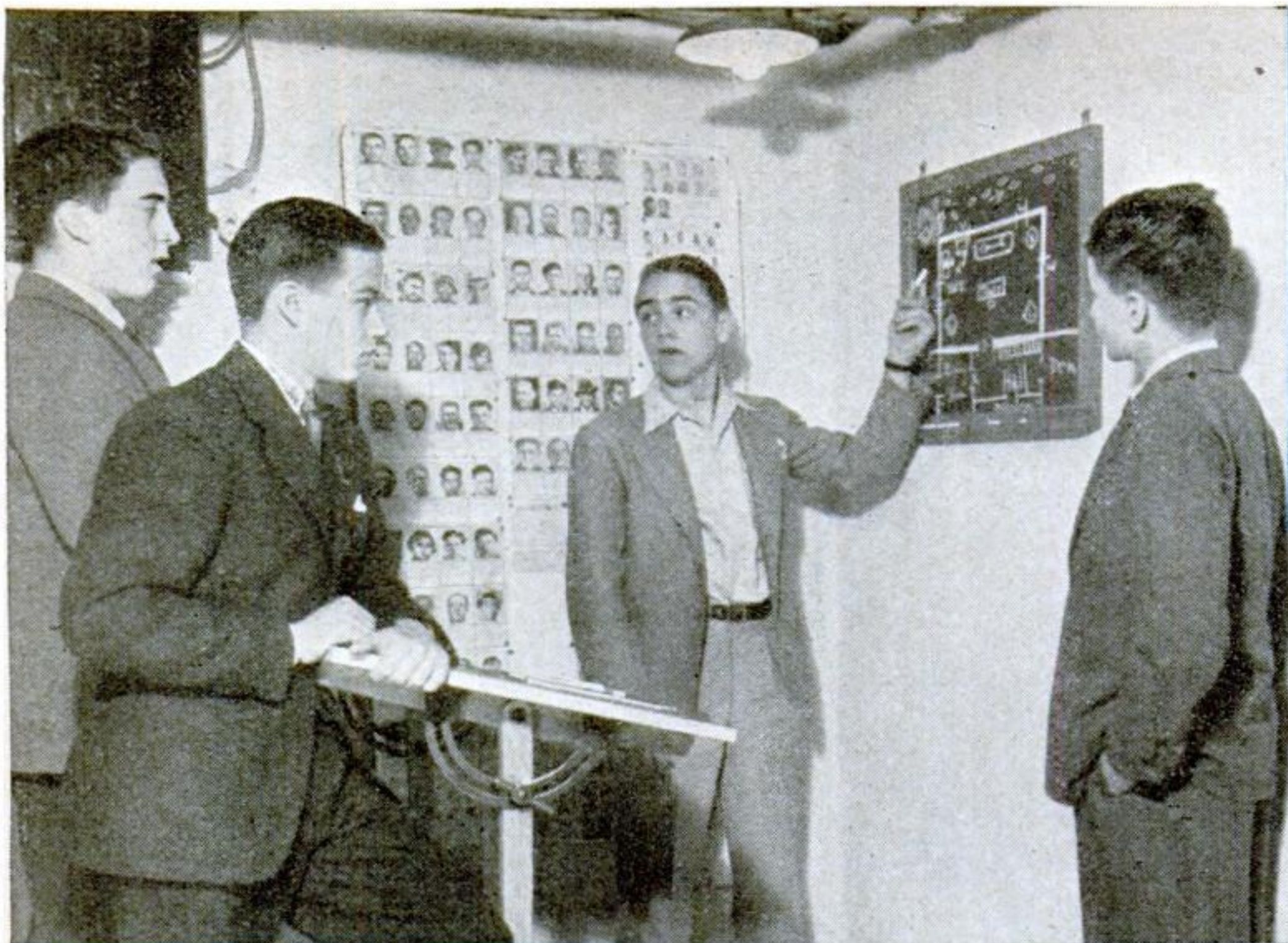
The story of the Tri-State Detective Agency goes back to the fall of 1936. On Halloween night, some one smeared paint on the stone wall facing the Bassette home. Then and there, Roy, who had always been fascinated by police methods and the ways of scientific detectives, determined to form a boys' detective agency to combat the disfigurement and destruction of property. The three original associate detectives were Don Williams,

Henry Jarvis, and Payson Langley. Today, they form the Headquarters Staff of the organization. Each has become an expert in a particular branch of scientific crime detection.

At first, the organization was called simply the Bassette Detective Agency. Roy complained that the name was too "personal" and it was finally decided to change it to the Tri-State Detective Agency. Before this could be

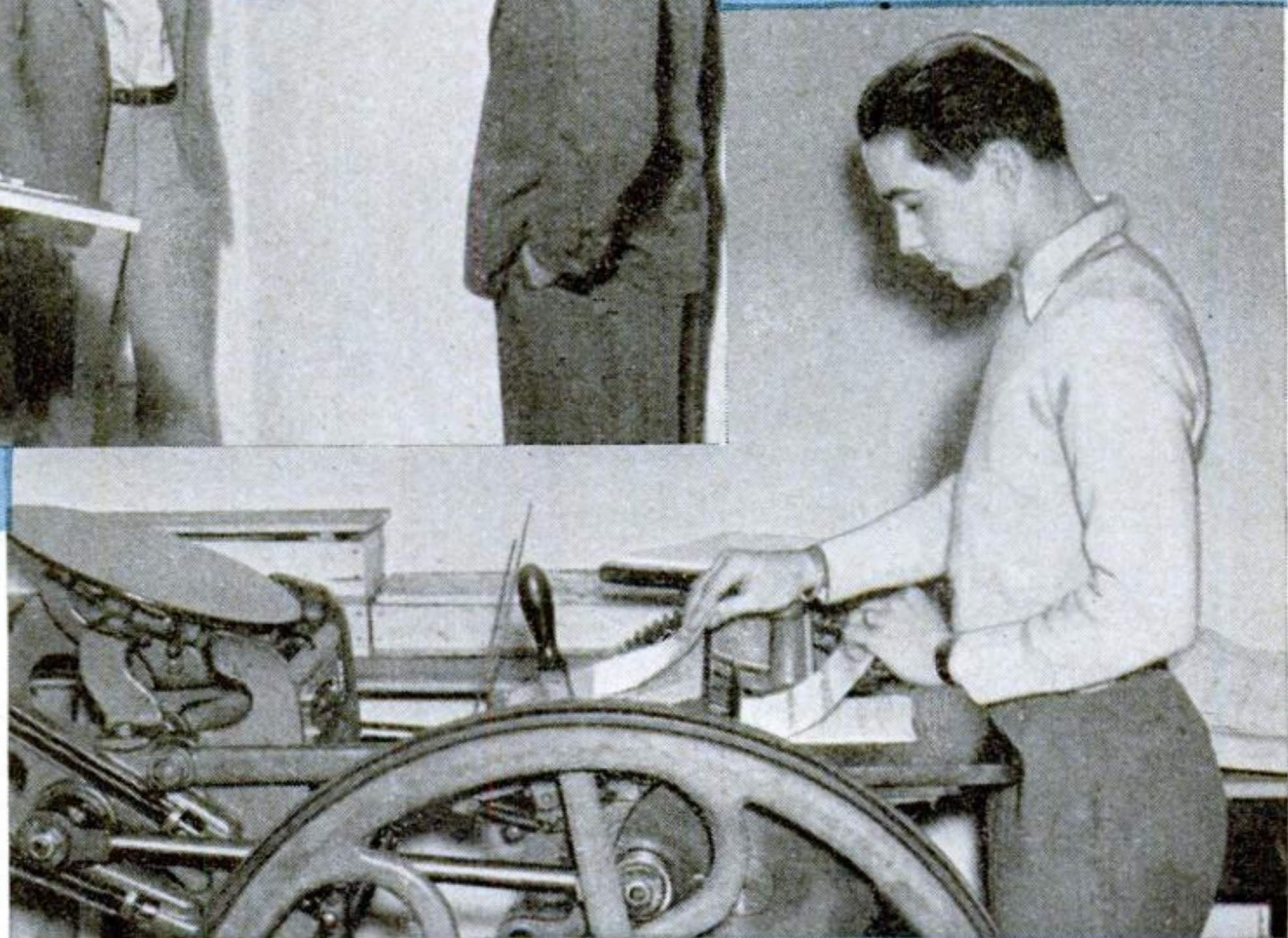
Headquarters for the agency is this basement criminological laboratory. Above, boys taking plaster casts of footprints. Below, the chief's badge





Chief Bassette explaining a crime-detection problem with the aid of blackboard diagrams

A modern printing press, below, turns out application blanks, notices, and other printed forms



done, however, it was necessary to get members in two other states. This proved comparatively easy. Young Bassette had a friend in Massachusetts who was glad to form a branch. Then, Roy drafted his older brother who was in New York City, and thus was able to assume the tri-state title without further ado.

Today, a colored map of the United States hangs on one side of the basement laboratory. Red marker pins on it indicate the location of branch agencies in many parts of the country. In addition, there are two branches in Canada and even one in far-away Paris, France.

As your eye runs around the white-walled basement headquarters of this active organization, you see chemicals, microscopes, cameras, enlargers, scientific apparatus of a dozen kinds. This equipment, which provides the youthful sleuths with a G-man laboratory in miniature, has been made possible by Bassette's father, an architect, who has become greatly interested in the work of the boys.

Ranged on a long wooden table in the center of the room are textbooks on chemistry, manuals on fingerprinting, law books, treatises on poisons, and assorted books on scientific crime detection. Beside them, in neat piles, lie the latest criminological magazines, Federal Bureau of Investigation bulletins, and police reports. In one corner of the laboratory, near a wall blackboard, are posted pictures and descriptions of wanted fugitives. Near-by is a bulletin board holding news clippings relating to the feats of scientific sleuths here and abroad.

The blackboard is in frequent use. Diagrams chalked on its sur-



Bassette fills out an application blank for a prospective member

face are used to study various steps in the correct solution of crimes. A projector and a screen also permit images of fingerprints and other material to be enlarged greatly for viewing and study. Part of the equipment of the squad car is a complete and compact kit for making plaster casts of footprints. Professional-type fingerprint outfits are also available for instant use. In spite of the completeness of their scientific equipment, the boy detectives are always on the alert for makeshift emergency methods. For instance, they have learned that they can easily bring out fingerprints by shaving off black dust from a lead pencil and spreading it like fingerprint powder over an area where prints have been left.

While all the members are grounded in the different phases of scientific crime detection, each has specialized in some branch of the work. Young Langley is custodian of the chemistry laboratory, Jarvis is in charge of the fingerprint section, while Williams operates the photographic department. In their work, the schoolboy Sherlocks are unconsciously picking up a foundation knowledge of many kinds of science.



Analyzing ink stains in the complete chemical laboratory at headquarters

Virtually all the planning and organizing in connection with the Tri-State Detective Agency has been done by the boys themselves. New members have to fill out a questionnaire which asks among other things: "Have you ever destroyed property which did not belong to you? Have you a police record? Have you a good reputation in your community?" The initiates must also swear to the "Code of

Conduct" of the agency. All members are strictly forbidden to play detective games with guns, revolvers, knives, or other weapons that might cause injury. For violation of the Code of Conduct, members are liable to suspension for varying periods. One recent rule read: "Any member of the Tri-State Detective Agency damaging property this Halloween will be suspended for life."

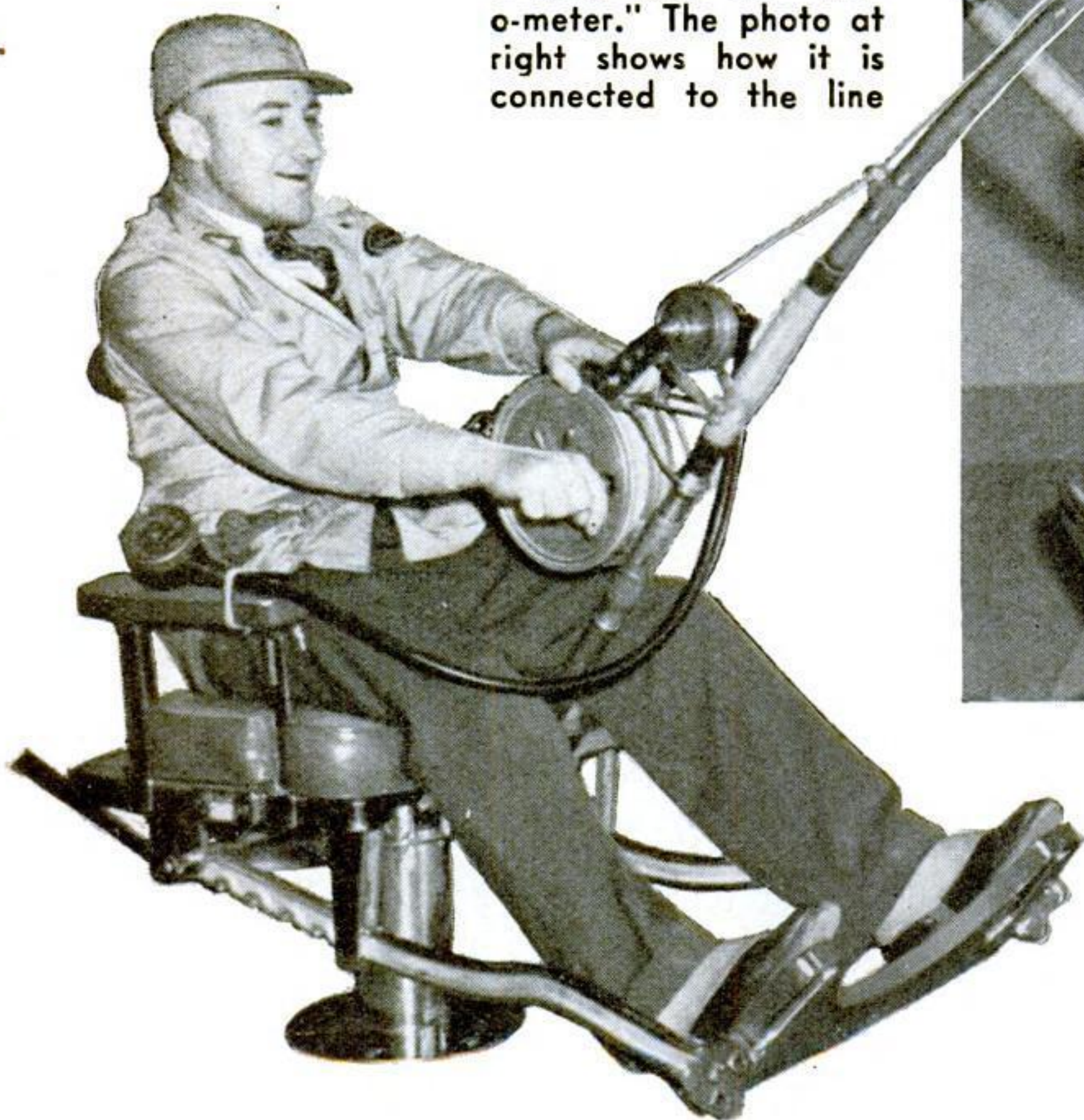
Each member receives a pin and his credentials. Promotion from member to inspector, lieutenant, and captain are made on the basis of written examinations. At the West Hartford headquarters, Bassette holds the title of Chief while Williams and Langley have be-



Up-to-date equipment is available in the agency's fingerprint section

Angler's Speedometer Shows How Fast Fish Swim

Earl Thompson clocking a tuna with his "fish-o-meter." The photo at right shows how it is connected to the line

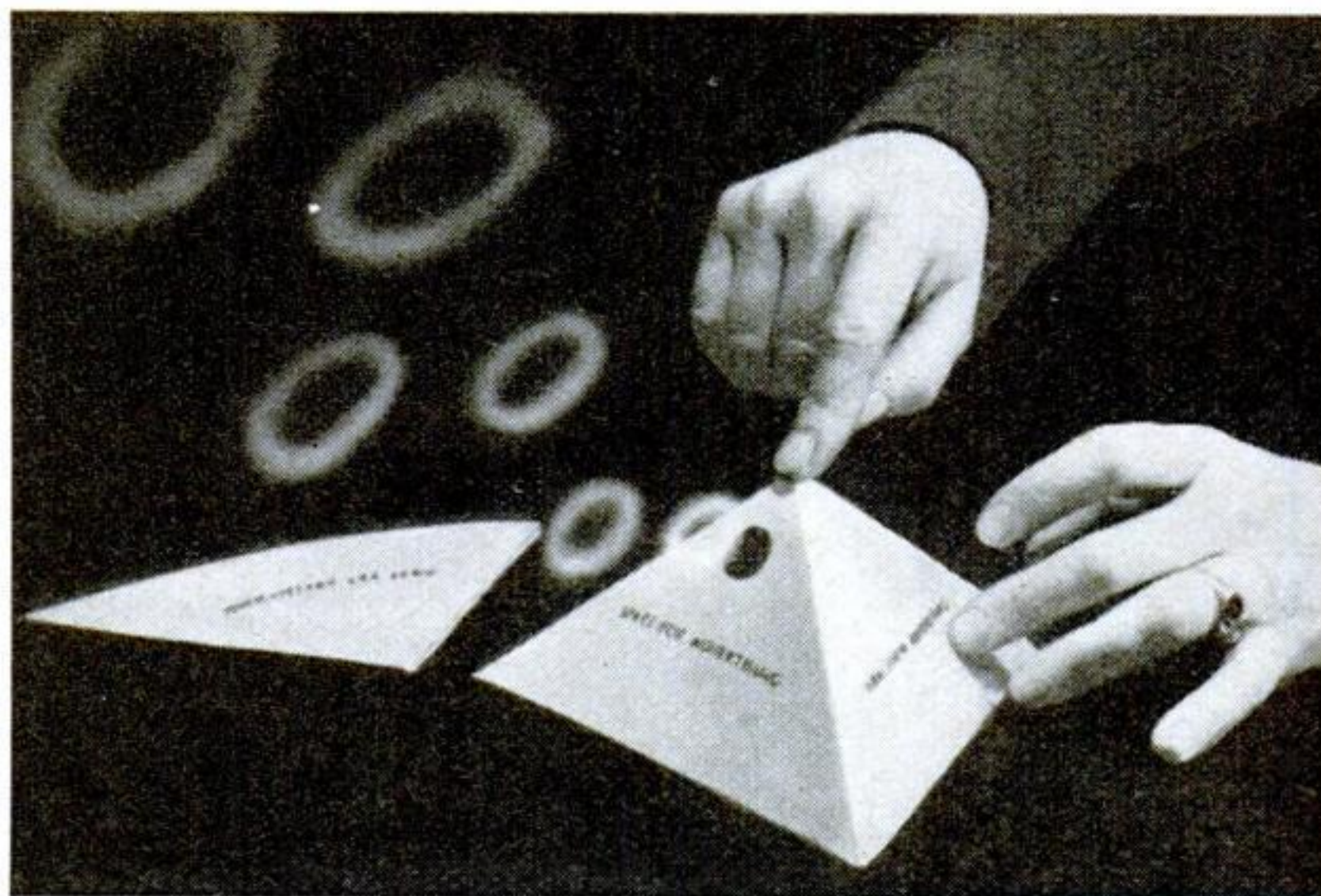


a pulley connected to the speedometer cable, so that the indicator needle registers the fish's speed in miles an hour without hindering the angler. Sportsmen a few years hence may be boasting, "I caught a 100-mile-an-hour baby today," instead of, "I took an 800-pounder."

Scientific men are interested in the possibilities of the invention. Big ocean fish have been reliably reported to attain "cruising" speeds up to thirty miles an hour, but the limit of their utmost efforts has been unknown. In the first test of the new "fish-o-meter," a baby bluefin tuna of sixty-pound weight ran the needle up to forty-four miles an hour. This summer Thompson hopes to find what a giant 700 or 800-pounder can do. He has been asked to report his findings to the Boston Museum of Natural History.

Advertising Novelty Blows Smoke Rings

SMOKE RINGS are easy to produce with a small cardboard pyramid introduced as an advertising novelty. Through a hole in the side, smoke may be blown into the interior. Then a series of quick taps ejects slender smoke rings that float lazily through the air, as shown in the illustration at the right. Pressing slowly on a side releases a fat ring. For best results, a spot free from drafts must be chosen, otherwise the air currents will quickly destroy the rings.



Tapping the cardboard pyramid forces smoke out in fine rings

Mystery Airplane Motor Requires No Pistons

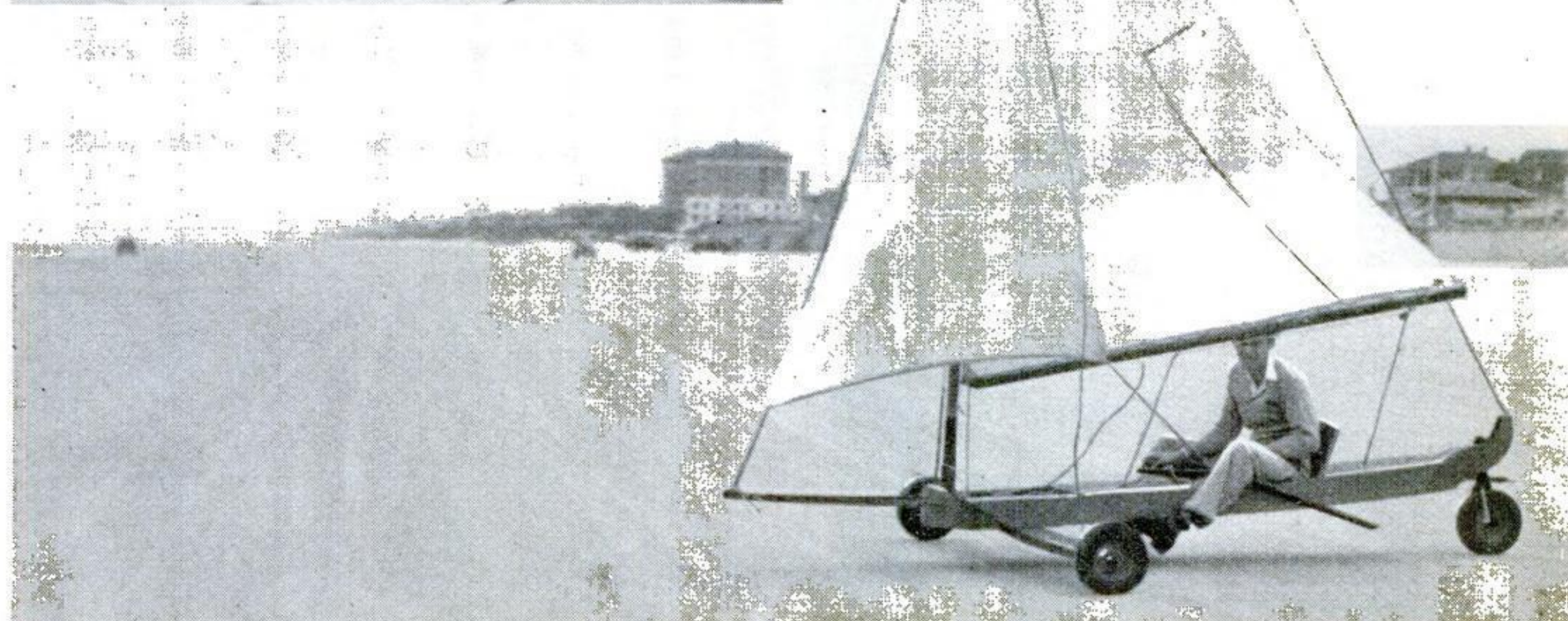
CAPABLE of driving a light bombing plane on 12,000-mile, nonstop flights, a 500-horsepower airplane engine recently developed is said to tip the scales at only 412 pounds, and to be four times as economical as present aviation power plants. Known details of the rotary-type mystery motor, soon to begin test flights in a special plane, include the facts that it requires only five bearings, has only thirty moving parts, and is minus cylinders, pistons, and connecting rods.

Odd Beach "Windmobile" Folds Up for Carrying

A LAND YACHT for sailing on wheels along sand beaches, race courses, or abandoned strips of highway, built by W. Keith Vining, of Daytona Beach, Fla., is collapsible so that it can be transported easily from place to place by automobile. Spars and furled sails are carried along the running board, while the frame, folding axle, and wheels are lashed to the car top.



Smaller and lighter than most airplane engines, the new powerful motor has only thirty parts that move



The fast land yacht on the sand at Daytona Beach, Fla. Inset shows it folded and packed on car for carrying



Hunts Needle in a Haystack

HOW LONG does it take to find a needle in a haystack? Jim Moran, Washington, D. C., publicity man, recently dropped a needle into a convenient pile of hay, hopped in after it, and began an intensive search for (a) some publicity and (b) the needle. Having found the former, Moran abandoned the needle hunt.

Grapefruit Eaters Use Squirt Guard

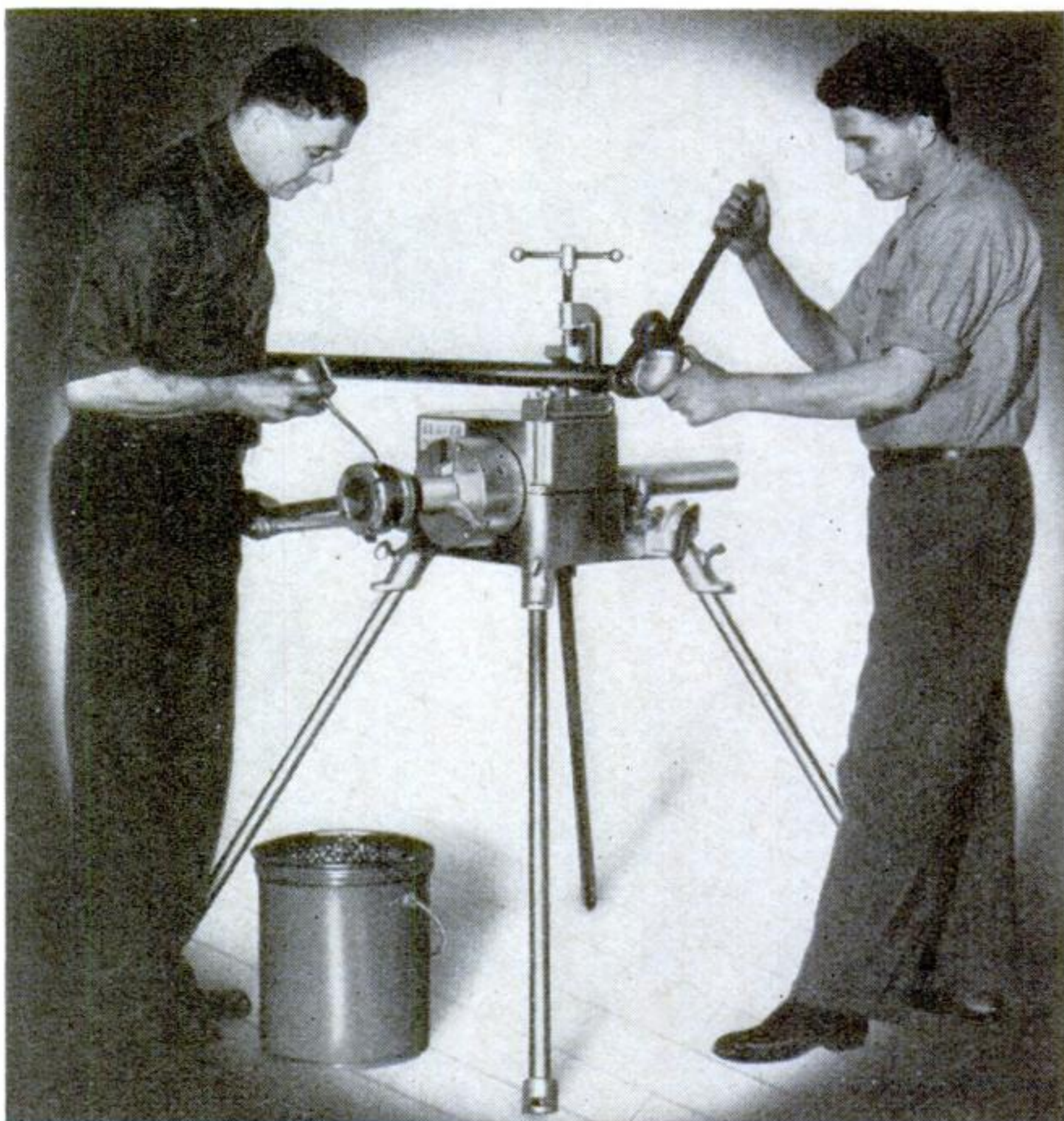
AT LAST someone has come to the rescue of grapefruit lovers by building a handy squirt guard. Invented in England, the hemisphere of celluloid clamps over a half grapefruit as a protection against stray juices.



Spoon is inserted through a small slot

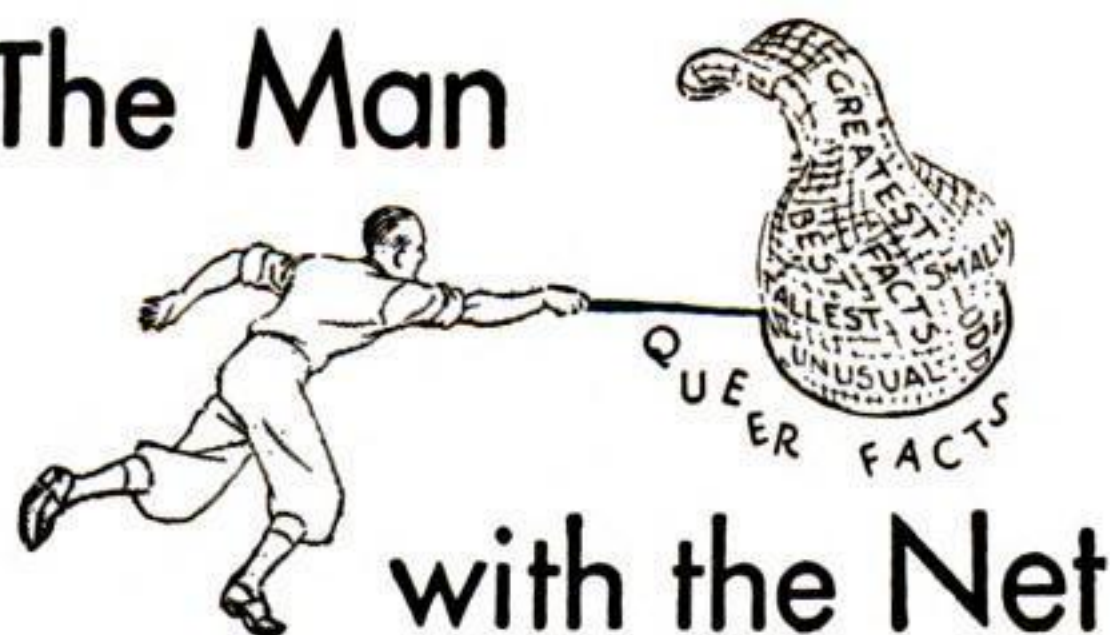
Portable Power Tool for Threading Pipe

ELECTRICITY replaces hand power for plumbers threading water and heating pipes, in a new portable power unit. Operated by a $1\frac{1}{2}$ -horsepower universal motor, the machine will thread pipe up to two-inch size with solid full-width dies, will thread bolts up to $1\frac{1}{2}$ -inch size, and will drive geared power tools to thread pipe up to eight inches in diameter. The unit is powerful enough to stop and start at the point of heaviest cutting without undue strain, and has sufficient reserve power to compensate for dull dies and for low line voltage. Used either on a bench or with pipe legs, the machine is designed so that two men can work at once—one cutting and the other bending and fitting, as at the right. Built-in accessories make the unit a portable pipe-fitting bench in itself.



Two men using power thread cutter. It can also be used on a bench

The Man



with the Net

BREAKING GLASS cracks at a speed of nearly a mile a minute.

WATER in the Hudson River at Albany, N. Y., is only six feet higher than it is at New York City, 150 miles away.

ENOUGH BOARDS to build a ten-foot fence around the world could be cut from the 250,000,000 trees damaged and felled last autumn by the New England hurricane.

MAYBE THAT WOULDN'T BE SUCH A BAD IDEA!



QUEEN BEES have about 1,600 parts to their feelers; drone bees have as many as 37,800.

EELS slender enough to pass through the eye of a darning needle have been captured near Cuba.

DRIED FRUIT, according to United States law, may contain no more than one insect to nine pieces.

FOUR PARROTS out of five are "left-handed," holding food in their left claws instead of their right.



AWRK - HOW CAN I BE LEFT HANDED IF I HAVE NO HANDS

LONG ISLAND has a greater population than any one of forty-two states in the Union.

THOMAS JEFFERSON was the first American to write a scientific paper on fossils.

PLASTIC MATERIAL of a new kind, scientists have discovered, can be made from coffee.

POTATOES have been produced experimentally in various colors—red, blue, purple, and yellow.

SURE, BUT THEY HAVE TO BE GREEN FIRST!



This Fellow Is Hot Stuff with a Soldering Iron

THERE'S nothing like the flavor of a red-hot soldering iron, according to H. B. Funston, a mechanic, of Columbus, Ohio. Most people will be content, however, to take his word for it. You see him above indulging his odd taste. How he applies the iron to his tongue without injury remains a mystery.

Compact Copying Outfit Resembles a Suitcase

SO SIMPLE that anyone can use it, a new portable printer speedily makes photographic duplicates of tracings, drawings, letters, reports, maps, and designs. Contact prints up to twelve by eighteen inches in size, made upon a special sensitized paper, can be exposed, developed, and dried ready for use in only five minutes' time. Folding into compact form like a suitcase, the device weighs less than thirty-three pounds.



Duplicating a drawing with the high-speed printer



A little mother sends out her doll clothes along with the family wash. Right, tiny garments on a conveyor at the laundry's plant

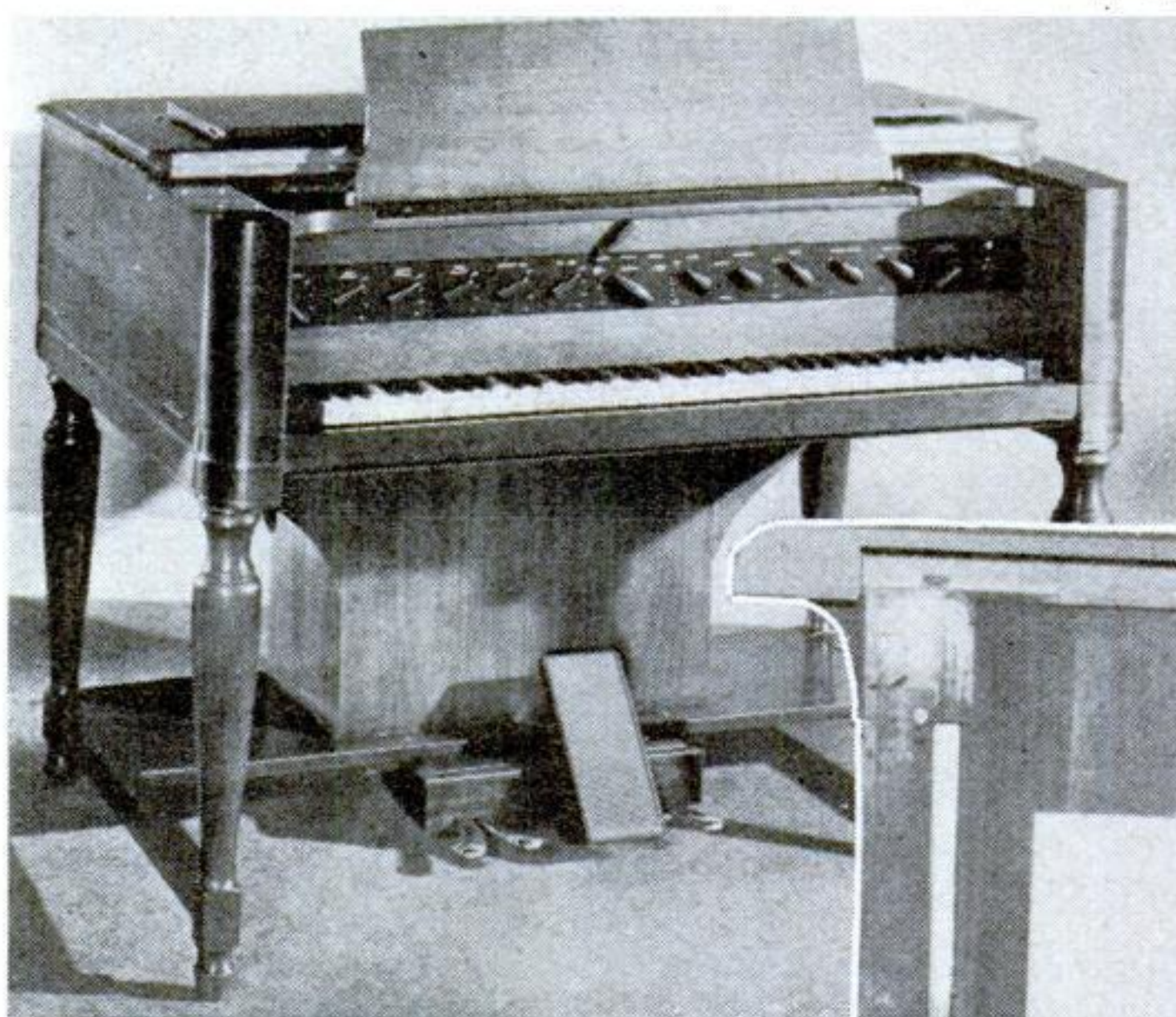
Laundry Service for Dolls

LITTLE girls in New York City who are too busy raising a family of dolls to think of washing all their dolls' clothes can now send them out. A commercial laundry furnishes a tiny laundry bag and a special doll laundry slip for the child to list doll clothes sent out and check them when they are returned along with the family wash.



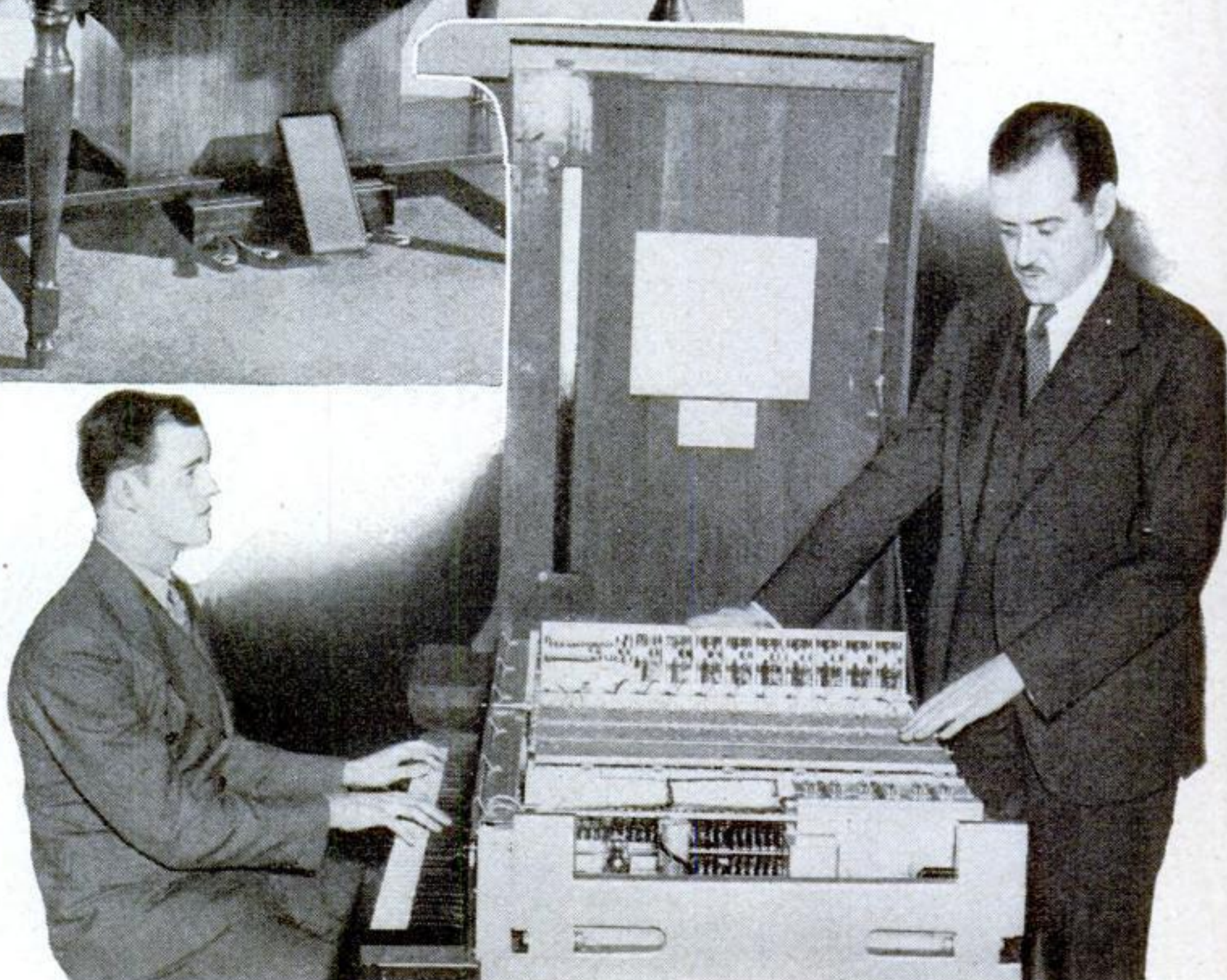
Electric Piano Is a One-Man Orchestra

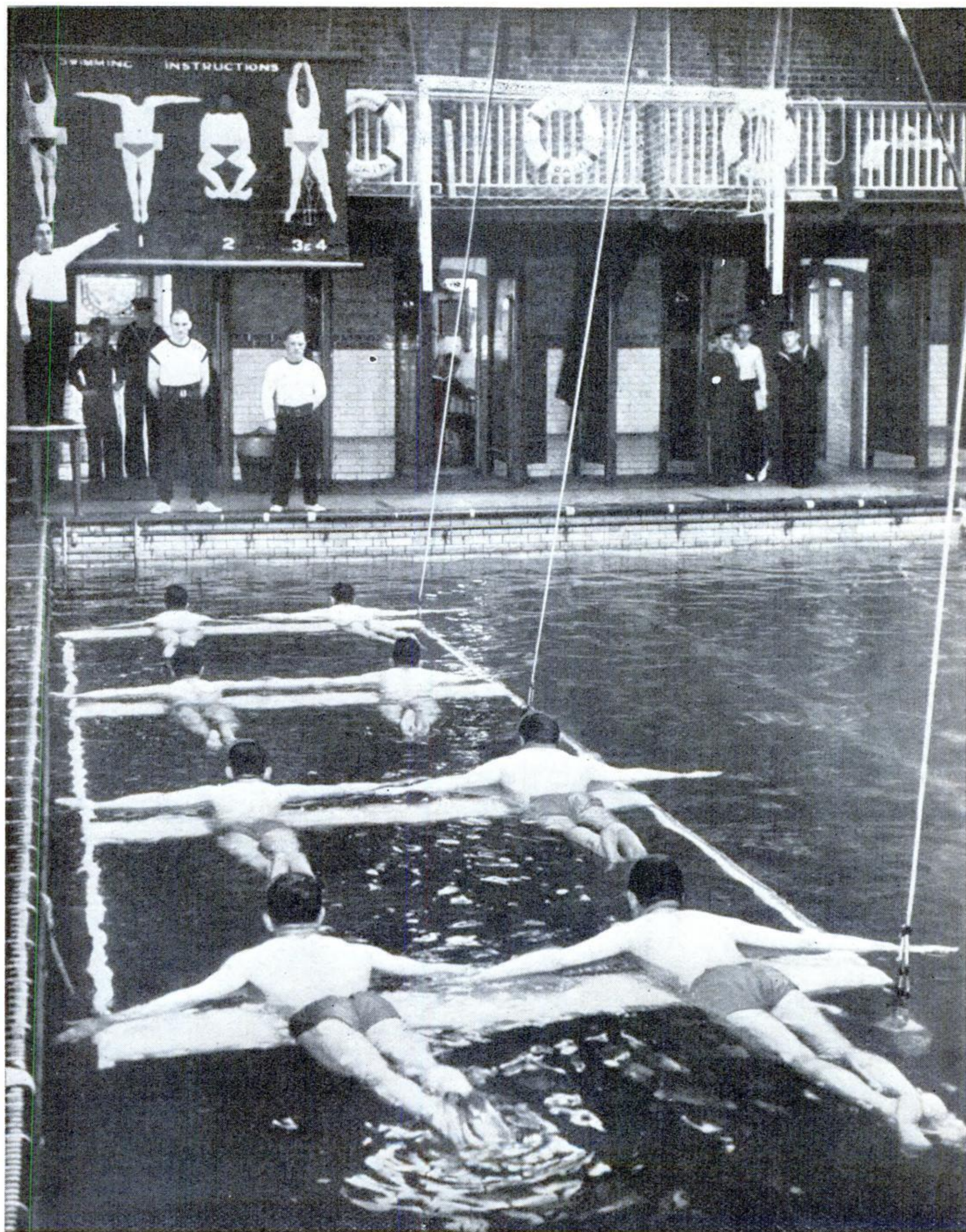
MUSICAL tones almost identical with those produced by a piano, harpsicord, oboe, violin, trumpet, French horn, and other instruments are created by an amazing electric piano recently invented by Laurens Hammond, of New York City. Fitted with a single keyboard of seventy-two keys, which are operated exactly like those of a piano, the electric orchestra contains no pipes, reeds, strings, hammers, or other vibrating parts, but produces its tones solely through a circuit of tuned vacuum tubes. These tones are varied over a wide range by means of simple controls mounted on a panel above the keyboard. Volume of sound is controlled accurately by a foot pedal.



Simple controls above the keyboard produce a wide variety of tones

Laurens Hammond, at the right, below, reveals the inner workings of his new electric piano





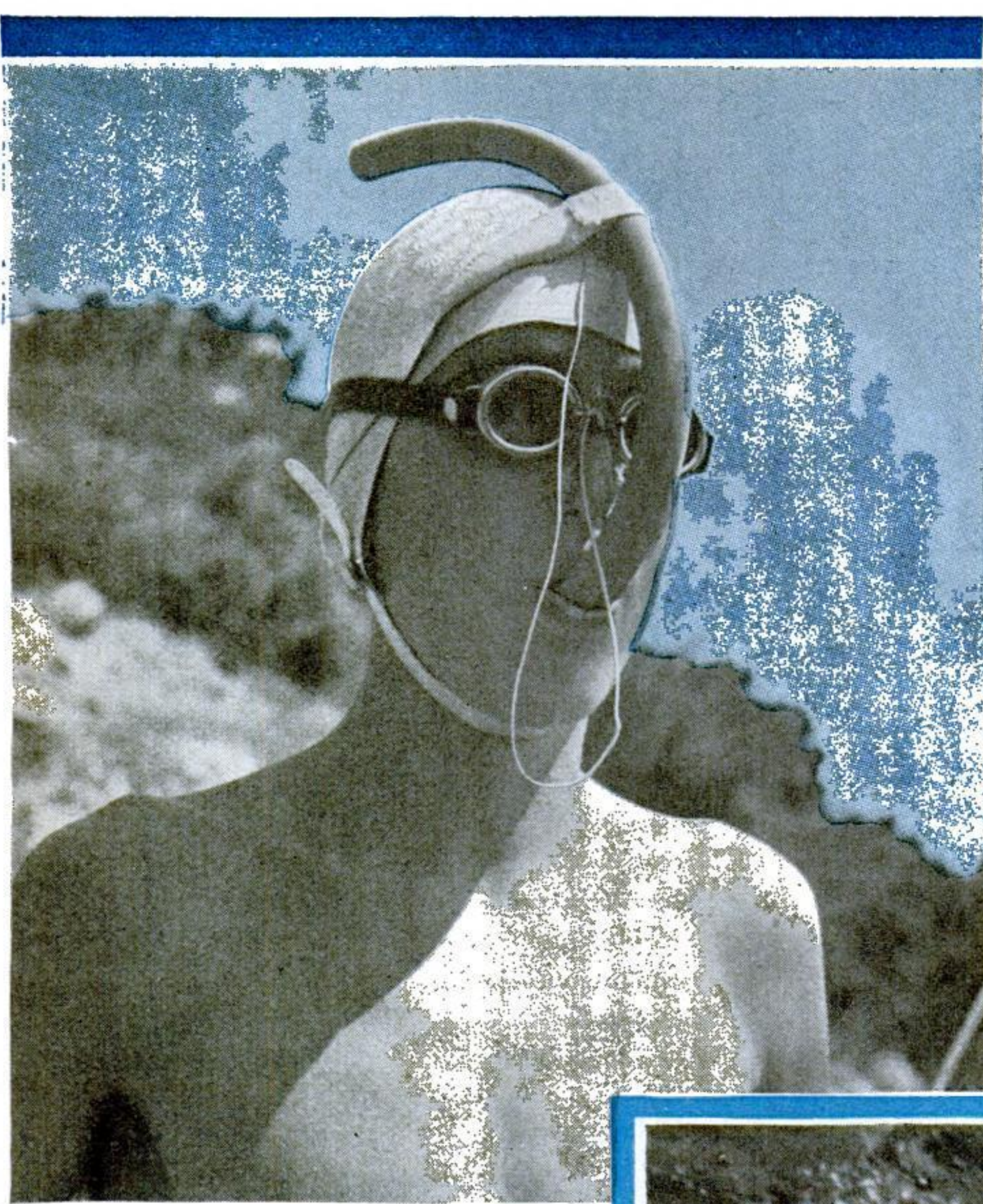
Sailors Get Group Swimming Drills

EIGHT novices learn to swim at once by a timesaving method of instruction adopted by the British Navy. Supported tandem fashion by the platform shown above in a pool at Devonport, England, the sailors follow the orders of their swimming teacher in the man-

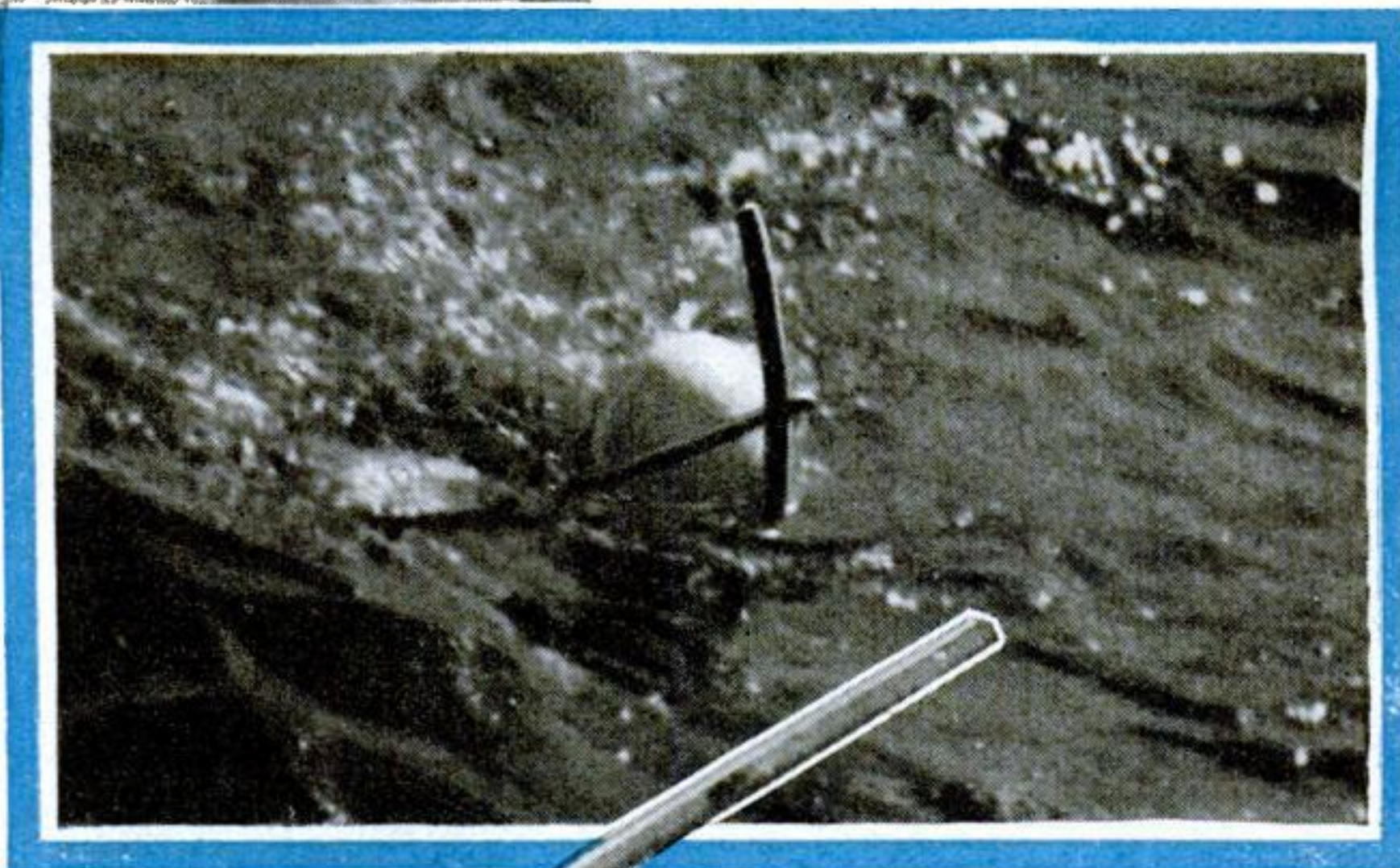
ner of a military drill. Four lessons are declared to be sufficient, cutting in half the time formerly required. Intensive training methods were decided upon when a survey showed that as many as thirty percent of British sailors were unable to swim.

HUMAN

FISH are shot with steel arrows by human submarines who cruise just below the surface of the water, in a novel variation on the sport of underwater fish hunting, which has gained great popularity along the shores of the Mediterranean. Donning goggles, and closing his nostrils with a nose clamp, the underwater hunter places one end of a rubber breathing tube in his mouth, wades into the water, and propels himself just beneath the surface by paddling with the aid of curious webfoot attachments strapped to his ankles. The open end of the rubber tube is held upright above the water by a loop on the



With a clamp on his nose and a breathing tube strapped to his bathing cap, a swimmer is ready for the new style of hunting fish under the water



Cruising along just below the surface, he breathes through the tube while he watches for his prey. Goggles give underwater vision. Left, up with a catch

SUBMARINE SHOOTS FISH WITH ARROWS

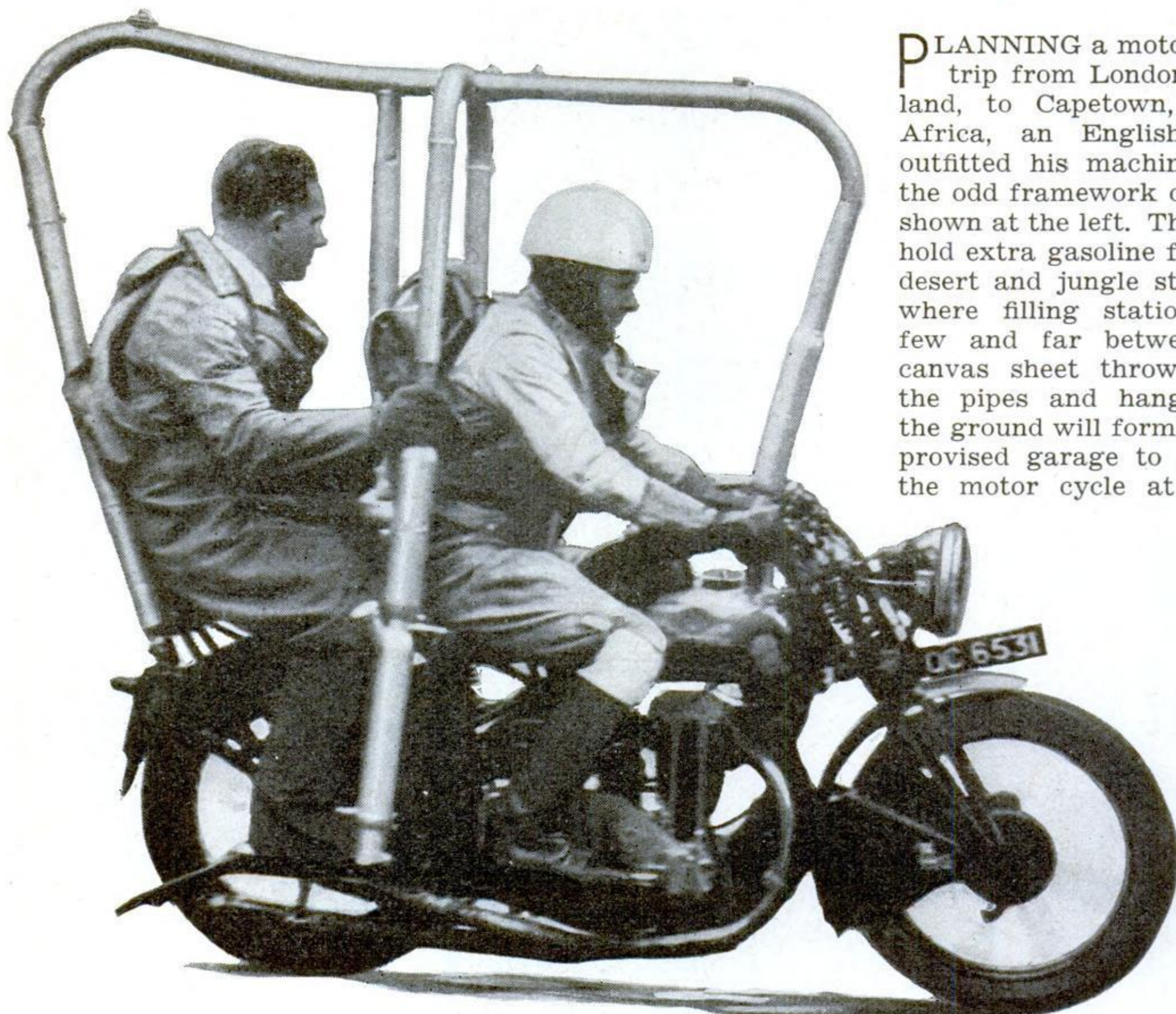
forehead of his bathing cap, permitting the submarine angler to breathe easily as he stalks his prey with a curious weapon similar in some respects to a medieval crossbow. Aimed and discharged like a gun, the weapon comprises a long wooden shaft along which is stretched a strong elastic cord made of a woven fabric. This is held in cocked position by a special trigger device. A slender steel spear, thin as an arrow, is then put in place in such a way that the elastic, when released by the trigger, will drive the slim missile through the water accurately and with tremendous force and speed. Photographs on these pages show various phases of this unusual form of hunting fish under the water.



Looking like a strange amphibian creature, half man, half fish, the devotee of the new sport wears webfoot attachments strapped to his ankles so that he can paddle along in the manner of a duck

Loading the weapon. Somewhat resembling a medieval crossbow, it uses a strong elastic cord to drive a slender steel shaft through the water with great force

Motor Cycle Equipped for Jungle Trip



PLANNING a motor-cycle trip from London, England, to Capetown, South Africa, an English rider outfitted his machine with the odd framework of pipes shown at the left. The pipes hold extra gasoline for long desert and jungle stretches where filling stations are few and far between. A canvas sheet thrown over the pipes and hanging to the ground will form an improvised garage to protect the motor cycle at night.

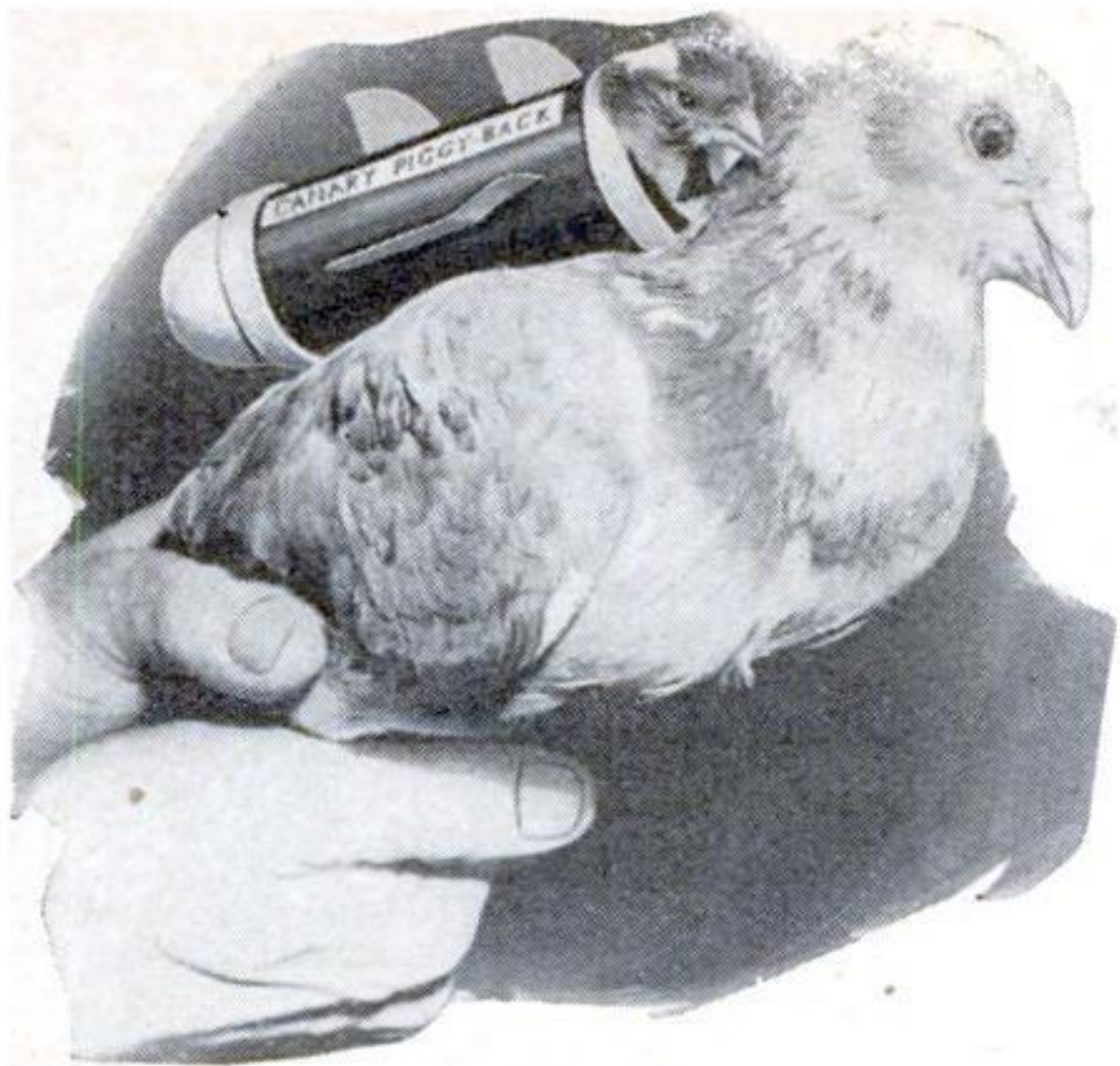
A cover will be stretched over the framework of pipes at night

Model Shows How Electric Waves Act

How does a wave of electricity behave when a lightning bolt strikes a power-transmission line, or a short circuit occurs? To demonstrate the answer to this question visibly, for purposes of electrical research, C. F. Wagner, Westinghouse research expert, devised a curious wave model on which an electric current is shown by synchronized movements of a row of fifty-six long aluminum arms.



Movement of metal bars illustrates what happens when a short circuit occurs



Pigeon Packs Papoose —and It's a Canary

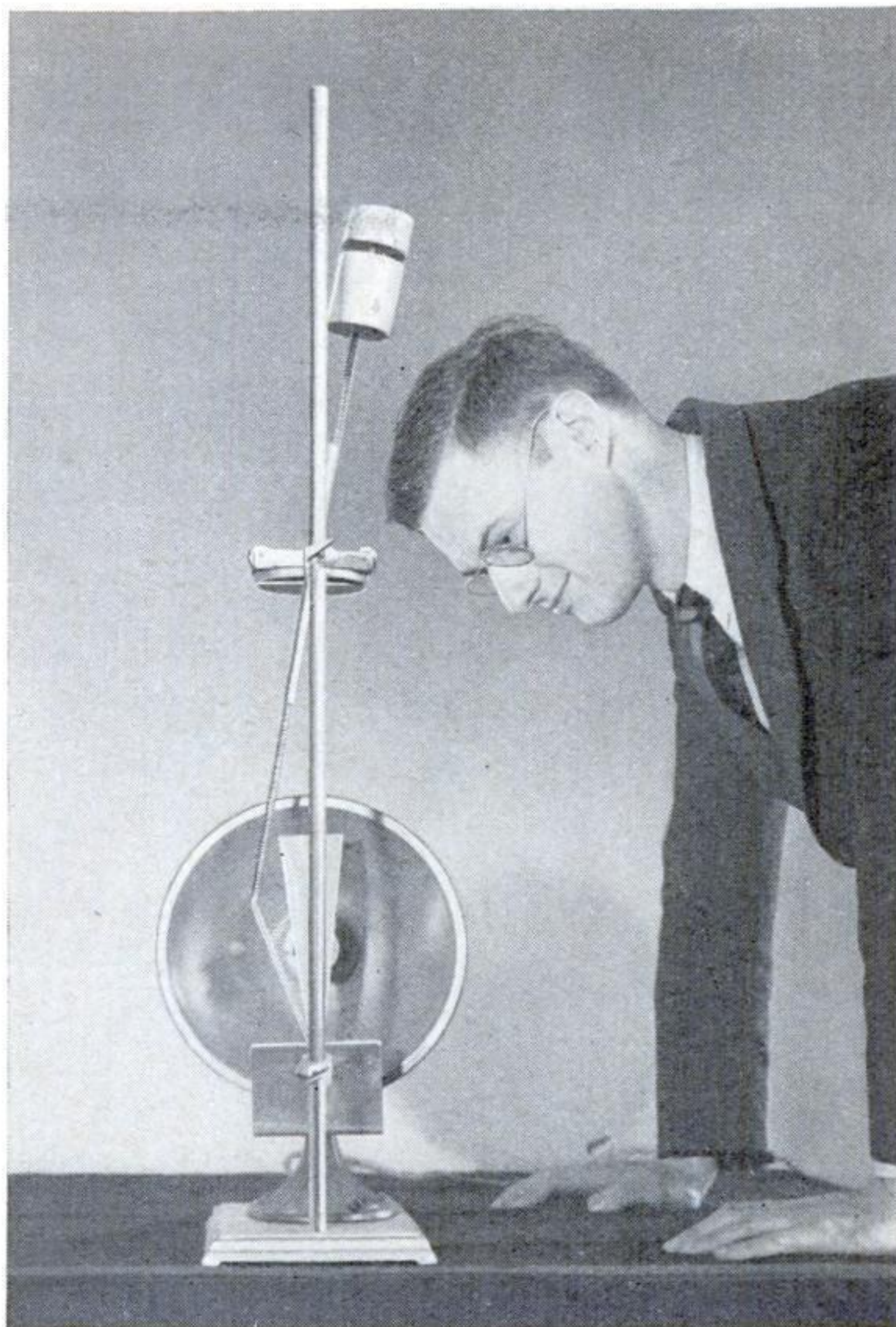
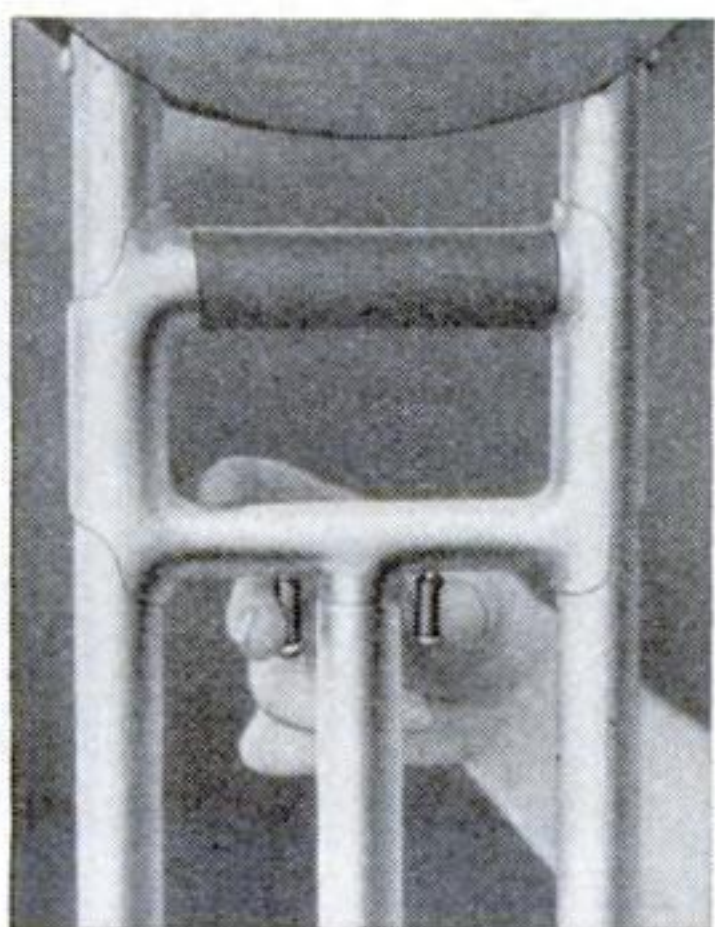
DELIVERING a pet canary "piggy-back," to a ten-year-old girl in a New York hospital, was a stunt chosen to open a national wild-life program a few weeks ago. The picture above shows the canary nestling in a tiny cockpit fastened to the back of a homing pigeon, all ready for its twenty-mile air jaunt.

Telescoping Crutches Are Adjustable



Release, right,
allows crutch
to telescope

MADE of aluminum, an improved crutch is adjustable to any height, and telescopes into small space when not in use. The central bar and its oblong guide may be slid to any position when release buttons are pressed. Stops then engage holes in the bars to lock them.



Power from Rubber Drives Odd Engine

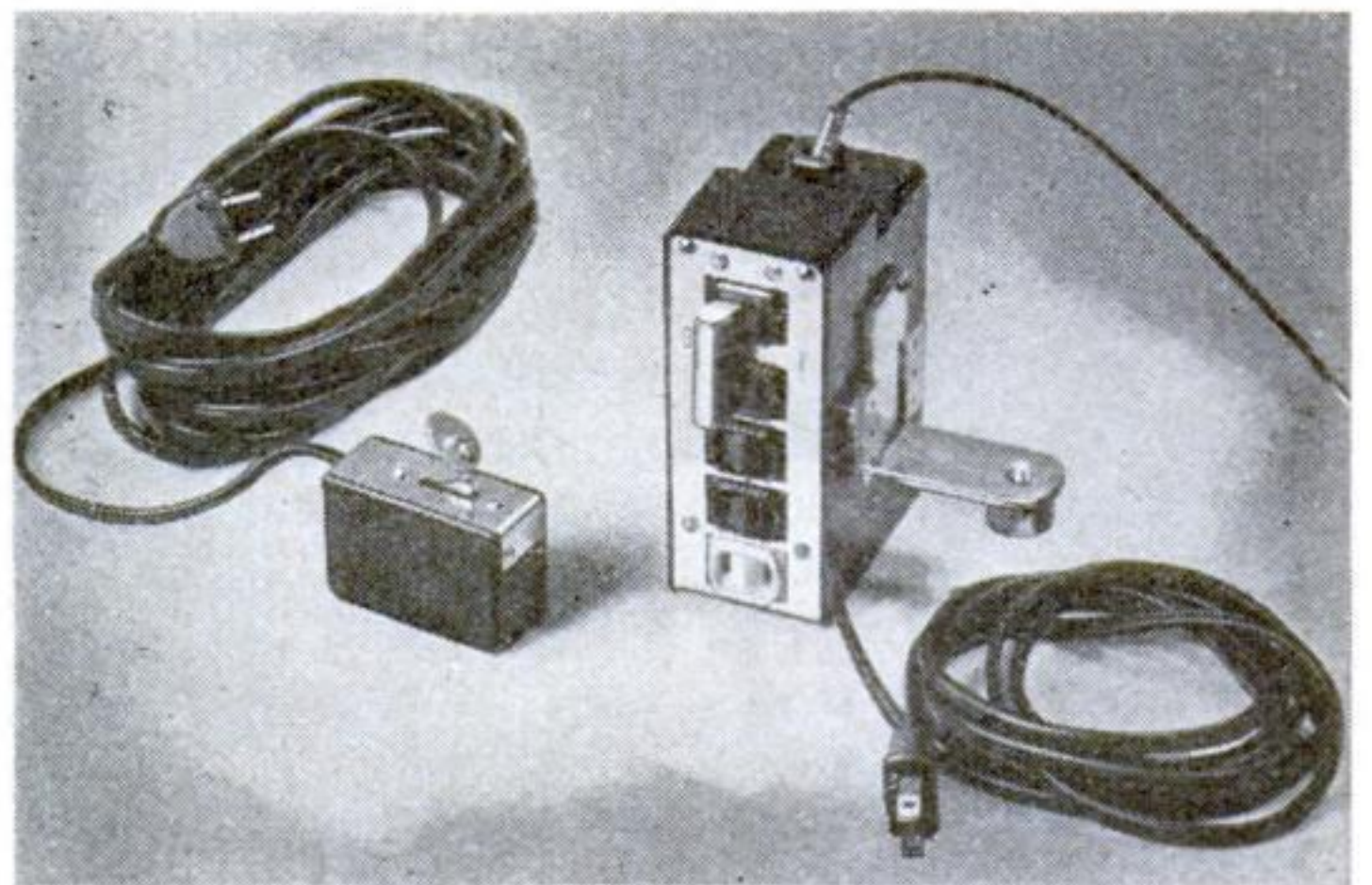
A "RUBBER PENDULUM," operating as a scientific curiosity at the National Bureau of Standards, demonstrates a novel way of making heat do work. Supported on knife edges, a pendulum bar topped by brass weights can rock as far from the vertical as the tension of rubber bands, restraining its lower end, will permit. Warmth from a radiant heater makes the rubber exhibit its unusual property of contracting under heat, instead of expanding as most substances do, and the shrinking bands pull the pendulum upright. At this point a sheet-metal shield screens them from the heat, and they relax. The momentum of the pendulum carries it over to the other side, where the process is repeated, and it continues to swing back and forth. A steam engine, which likewise transforms heat into mechanical energy, simply uses another working substance—steam—instead of rubber. In theory, a "heat engine" could employ any substance that expands or contracts with temperature changes.

Latest Aids



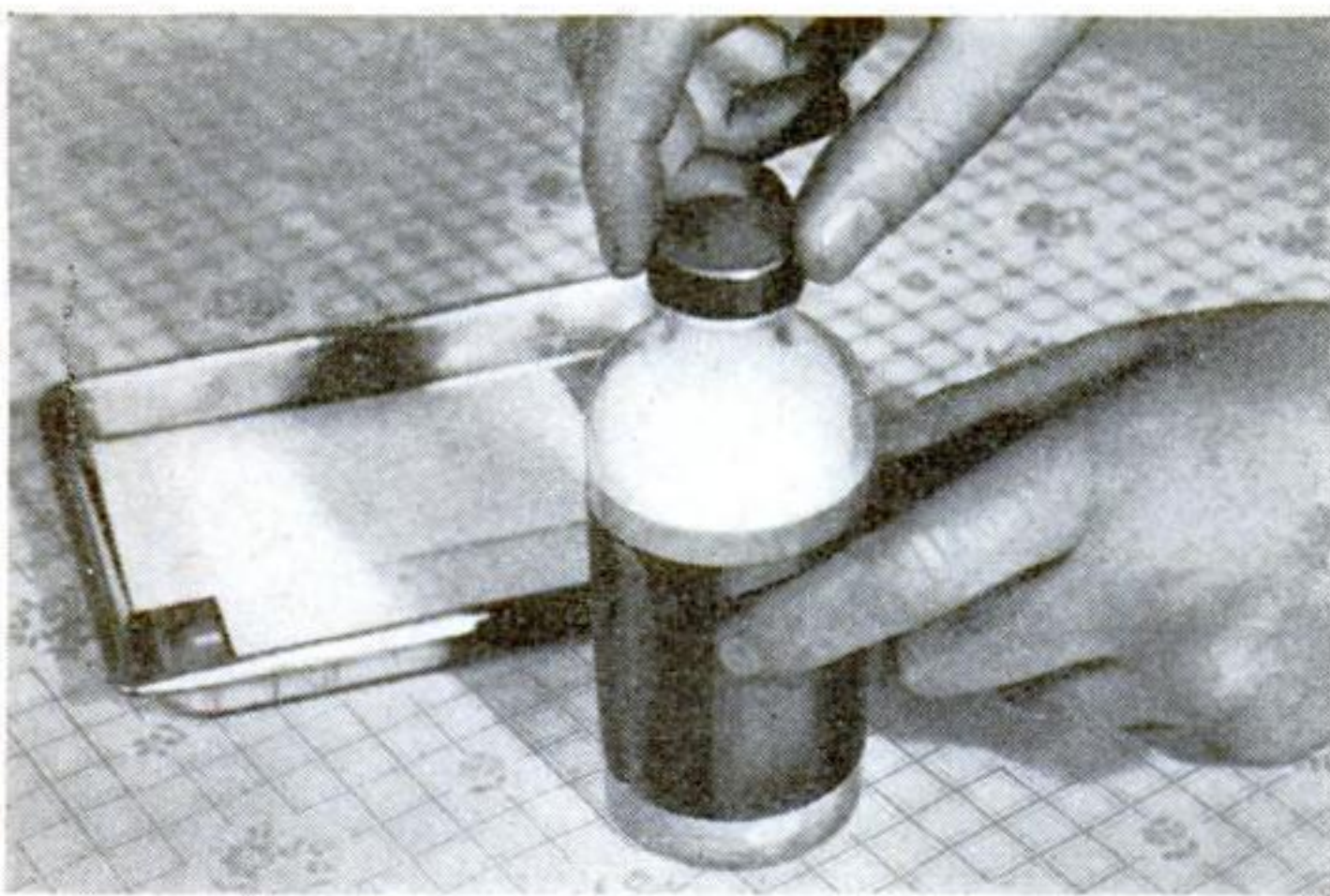
How the photoflood synchronizer is used. The camera shutter is operated by the light switch

SYNCHRONIZING light from photoflood bulbs with the opening and closing of a camera shutter, a compact new device is designed to fasten easily to the side of a camera. An electric-relay mechanism operates the shutter through a cable release when the lights are turned on by a special switch. With another switch, the flood lights can be turned on at reduced brilliance, lengthening their useful life, and making it possible to focus the camera without the usual glare.



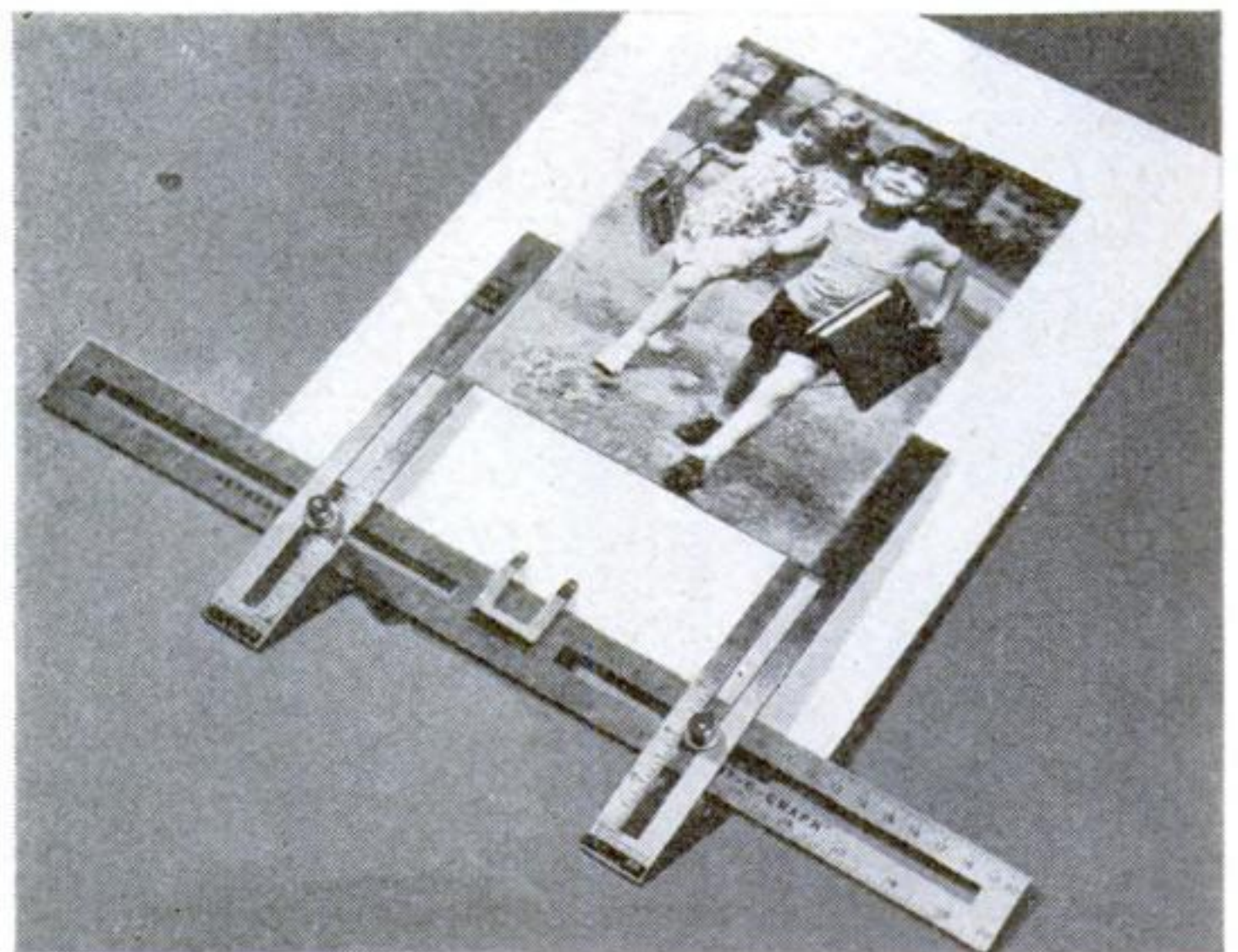
Device Centers Pictures on Mounting Boards

AN EASY means for centering photographs on mounting boards is provided by the handy measuring unit illustrated below. A lower, rulerlike member is clamped to the bottom of the board and centered by referring to scales at both ends. Moveable arms attached by thumbscrews are then adjusted so as to place the photograph in the center of the board.



New Chemical Prevents Watermarks on Films

PICTURES unmarred by watermarks are said to be assured by a new chemical that is simply wiped on negatives before the final washing. After fixing and a preliminary washing, the films are swabbed on both sides with a piece of cotton dipped in a dilute solution of the liquid. Final washing and drying are then accomplished without unsightly watermarks forming to ruin the prints.

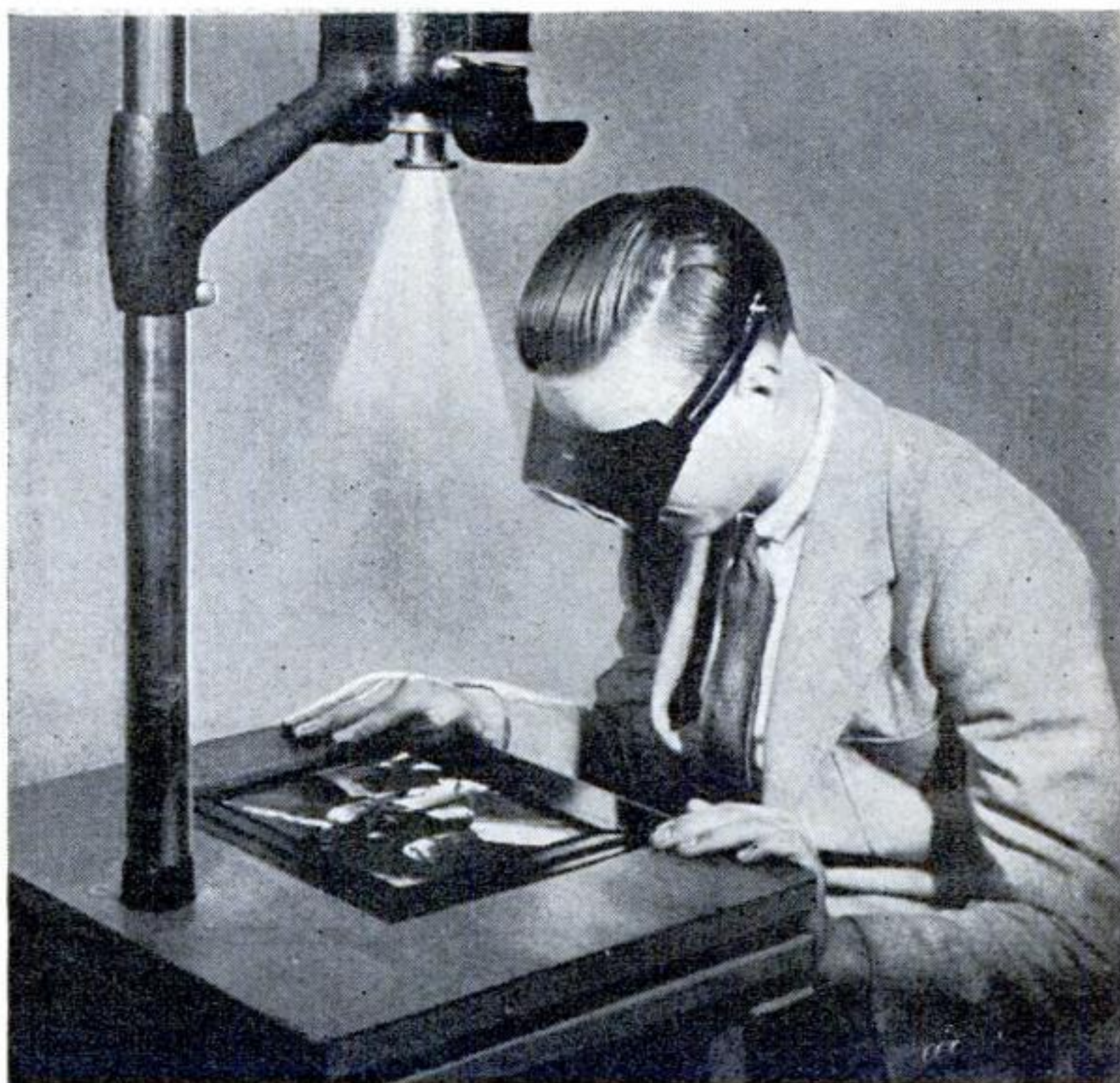
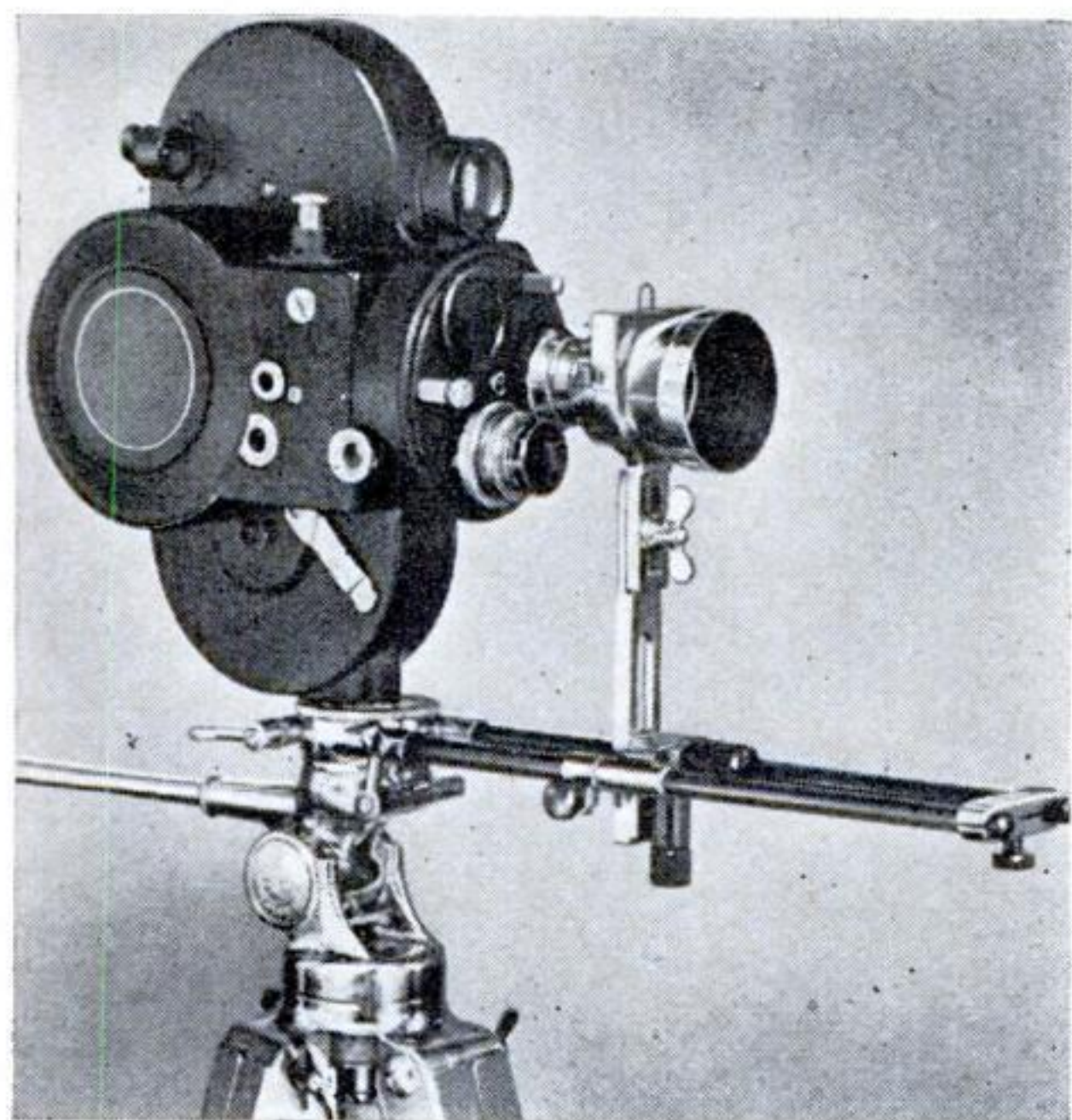


Upright arms center a photo on its mounting board

for Photography Fans

Bracket for Sunshade, Filter, and Title Cards

ATTACHED to the head of a tripod, a three-purpose assembly consisting of adjustable extension rods holds a camera-lens sunshade, serves as a filter holder, and may be used for making movie titles. Shown below coupled to a movie camera, the device is available for other types of cameras as well.



Magnifier Leaves Hands Free

MAGNIFYING lenses set in a pair of roomy goggles that can be worn even over a pair of ordinary eyeglasses are now available for amateur photographers, to show when an image is in sharp focus during the making of enlargements. Leaving both hands free, the binocular unit is also useful for examining negatives, and for other darkroom activities. A headband holds it in place.

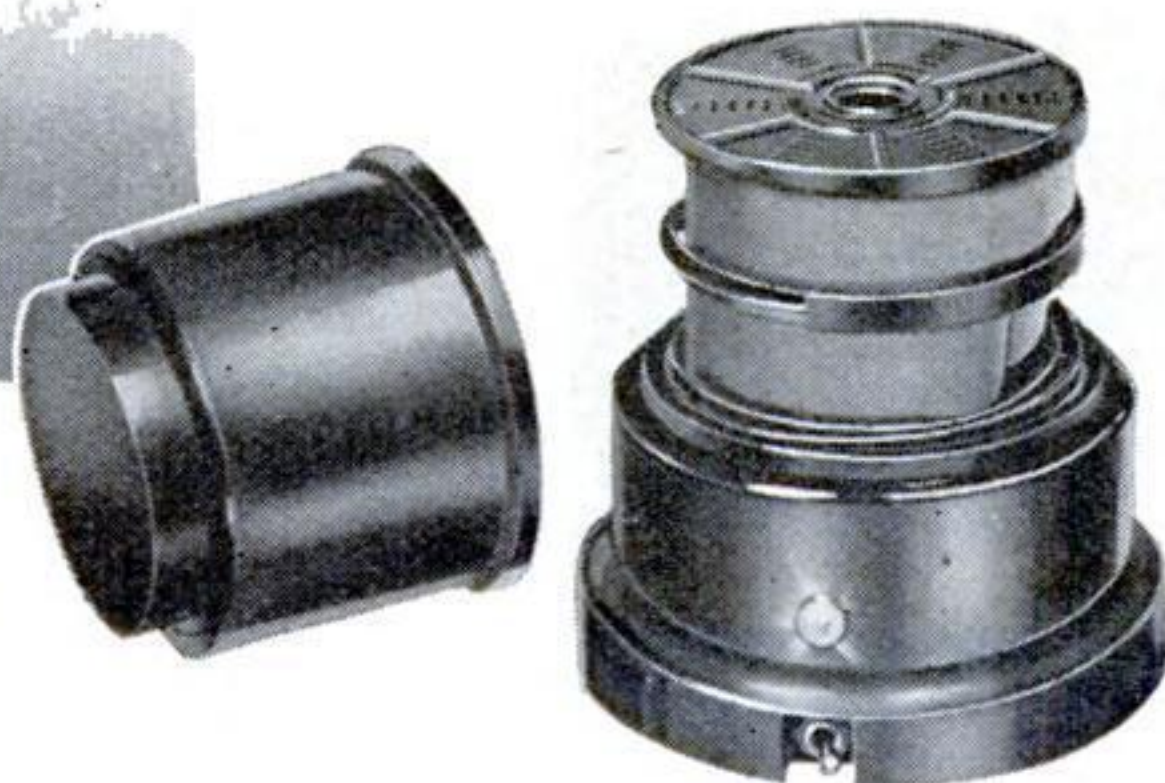


Chemicals placed in the vaporizer protect the film surface from damage. Right, a pilot light tells if the heating unit is on

Vaporizer Protects Dried Film

WOULD you like to be able to preserve your developed and dried films from damage by scratches, finger marks, and liquids? With the apparatus shown at the left and two chemicals furnished with it, you can, according to the manufacturer. Consisting of film spools and a tank equipped with an electric heater and a special cap, the device vaporizes the two chemicals in the presence of the films to give them a protective finish said to be practically damageproof. In addition, the

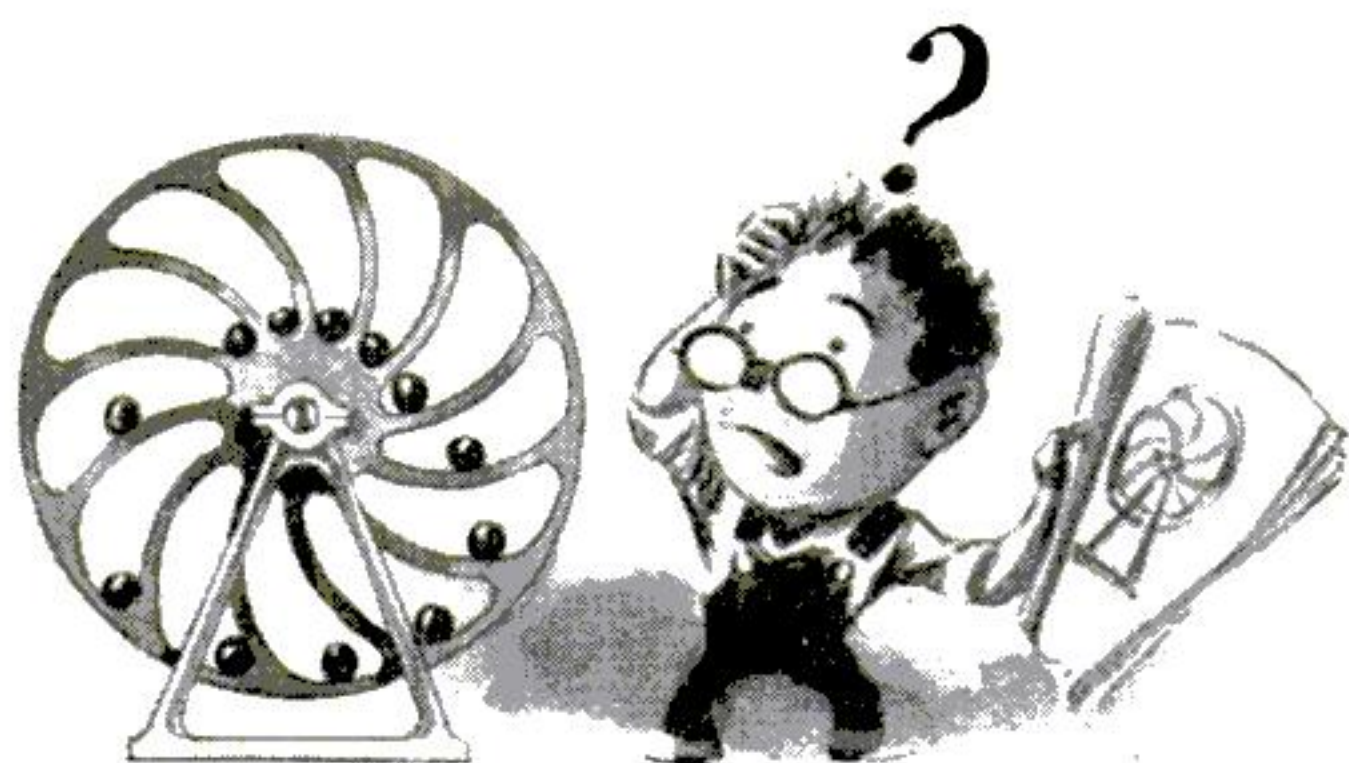
protective treatment safeguards the films against extremes of temperature. The vaporizing tank can be plugged into any household electric outlet. It is heated for ten minutes before inserting the film. A small quantity of one chemical is then placed in the top, as shown at the far left. Later the second chemical is added. The treatment takes about an hour to complete.



POPULAR SCIENCE

Question Bee

There is just one true statement in each of the numbered paragraphs below. Try to pick it out. Keep a record of your choices by the corresponding letters, and check your results on page 232



- 1 Perpetual-motion machines won't work, because of (a) the rotation of the earth (b) friction (c) air pressure (d) cosmic rays.
- 2 Your household gas meter registers the amount you use in (a) pounds (b) gallons (c) cubic feet (d) calories (e) kilowatt hours.
- 3 Cocobolo is (a) a handsome dark wood used by cabinetmakers (b) a beverage (c) a Canal Zone naval base (d) the Mexican word for "cockroach."
- 4 After a series of transformations, radium finally turns into (a) gold (b) carbon (c) amber (d) lead.
- 5 Solenoids will attract (a) flies (b) lightning (c) songbirds (d) iron (e) customers.
- 6 An autoclave is (a) a procession of motor cars at a public ceremony (b) a vessel for subjecting chemicals to elevated heat and pressure (c) an early form of player piano.
- 7 More than two thirds of the earth's surface is covered with (a) land (b) water (c) ice.
- 8 The twin bright stars in the constellation of Gemini are called (a) Scylla and Charybdis (b) Castor and Pollux (c) Damon and Pythias (d) Corsica and Tunisia.
- 9 Important light was shed on the ancestry of the human race by the discovery of the (a) Siamese twins (b) Cardiff giant (c) Gibson girl (d) Piltdown man.
- 10 Glass knobs on telegraph poles serve as (a) spark gaps (b) lightning arresters (c) insulators (d) turnbuckles.
- 11 Valence is a term used in (a) physics (b) chemistry (c) interior decorating.
- 12 You could measure small quantities of liquids accurately with a (a) lorgnette (b) burette (c) soubrette (d) barrette.
- 13 A compound rest is (a) the tool carriage of an engine lathe (b) a mark used in music (c) a mounting for an equatorial telescope.
- 14 Motions of molecules cease at (a) night (b) altitudes above 10,000 feet (c) absolute zero (d) the equator.
- 15 Under water, submarines are driven by (a) electric motors (b) Diesel engines (c) steam turbines (d) heavy-duty clock-work.
- 16 Asbestos is (a) an animal product (b) a vegetable product (c) a mineral product.
- 17 Tiny organisms floating in the sea are known collectively as (a) flotsam (b) plankton (c) ectoplasm (d) Oceania.
- 18 When ice forms on airplane wings, it endangers aviators by (a) freezing the gasoline in the wing tanks (b) creating radio static (c) changing the curvature of the wings.
- 19 The longest side of a right triangle is called the (a) abscissa (b) hypotenuse (c) perimeter (d) salient.
- 20 Canal rays are (a) markings observed on the planet Mars (b) beams of positive ions produced in vacuum tubes (c) large skatelike fish hunted in Venice, Italy.

EARN A DOLLAR

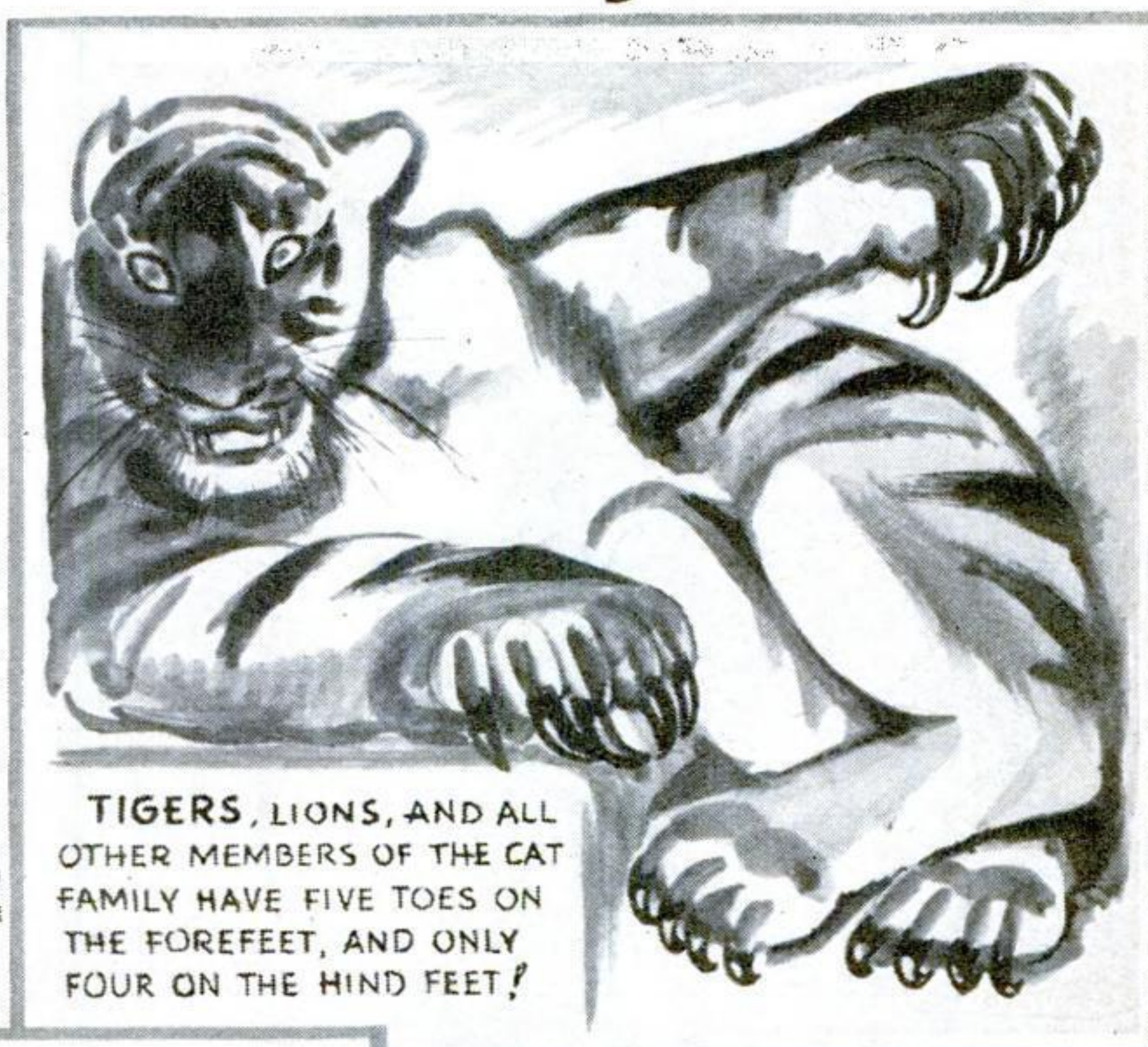
by sending us a question lively and interesting enough for use on this page! Submit as many entries as you like; each one accepted will be paid for at the \$1 rate. No contributions will be returned. Address the Question Bee Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York City.

Un-Natural History

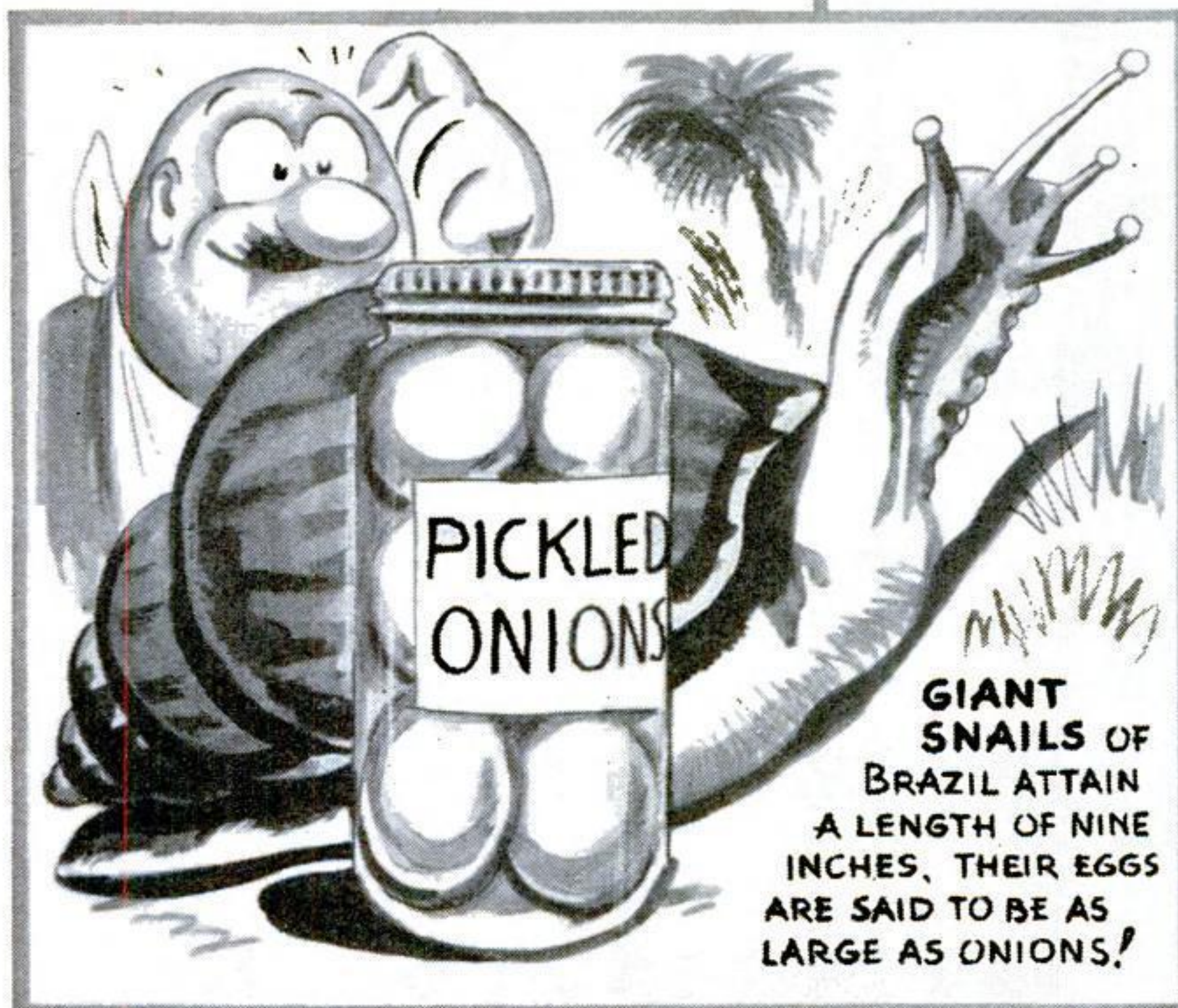
By
Gus Mager



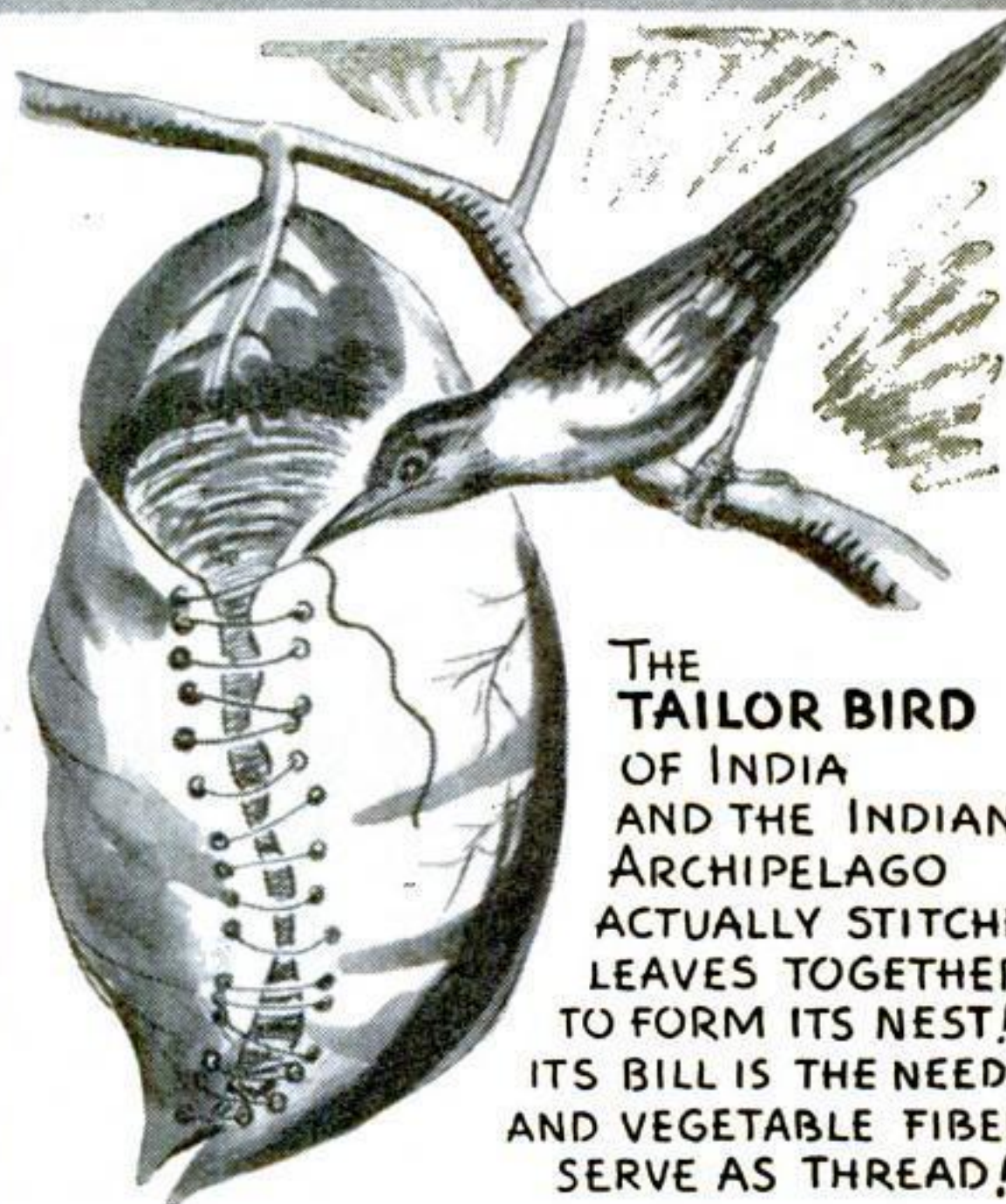
THERE IS A **SPRING** ON THE HIGHEST POINT IN THE UNITED STATES EAST OF THE ROCKIES - HARNEY PEAK, IN SOUTH DAKOTA, ELEVATION 7,242 FEET!



TIGERS, LIONS, AND ALL OTHER MEMBERS OF THE CAT FAMILY HAVE FIVE TOES ON THE FOREFEET, AND ONLY FOUR ON THE HIND FEET!



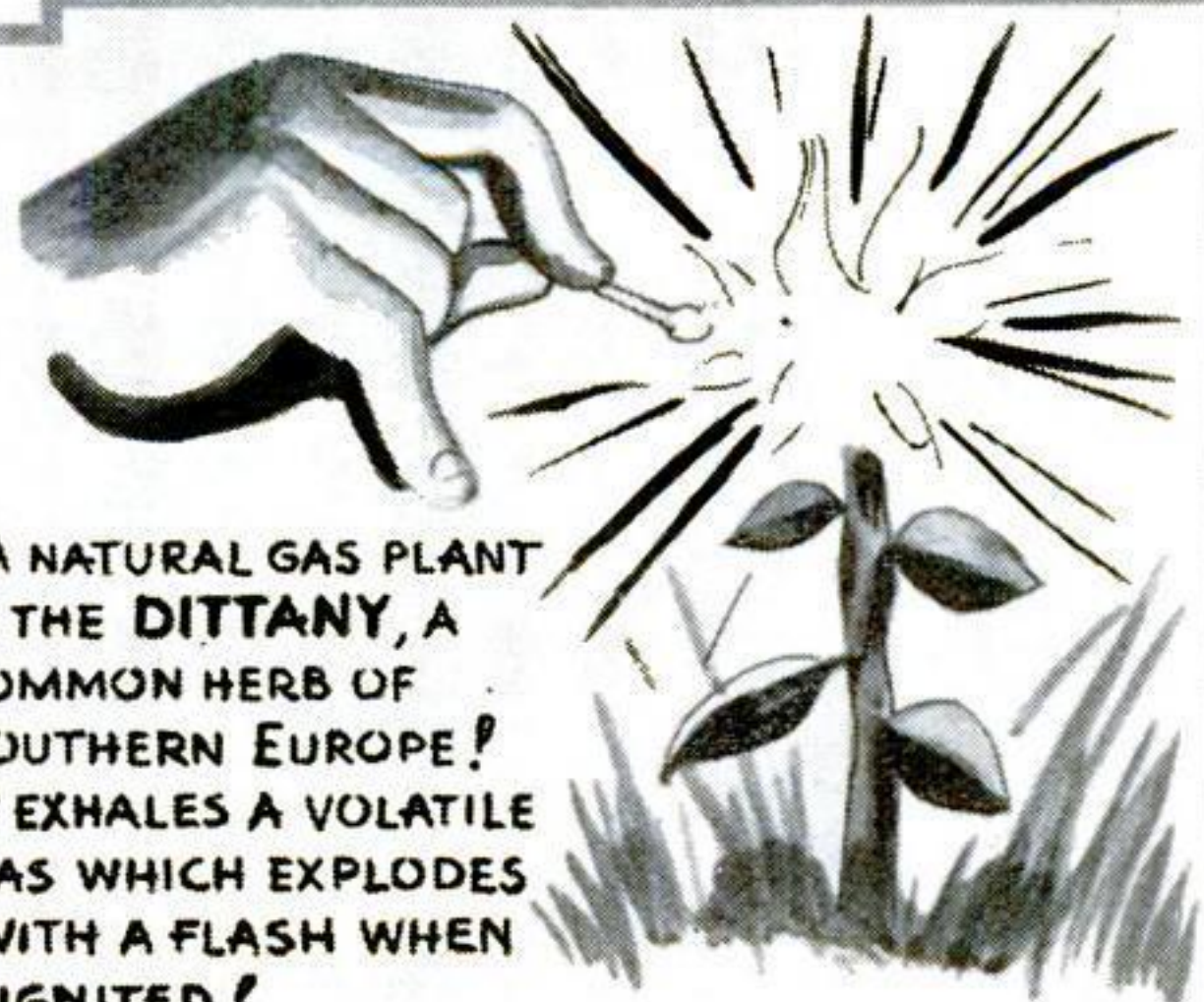
GIANT SNAILS OF BRAZIL ATTAIN A LENGTH OF NINE INCHES, THEIR EGGS ARE SAID TO BE AS LARGE AS ONIONS!



THE TAILOR BIRD OF INDIA AND THE INDIAN ARCHIPELAGO ACTUALLY STITCHES LEAVES TOGETHER TO FORM ITS NEST! ITS BILL IS THE NEEDLE, AND VEGETABLE FIBERS SERVE AS THREAD!



ONLY DOMESTIC SHEEP GROW WOOL! WILD SHEEP GROW HAIR!



A NATURAL GAS PLANT IS THE DITTANY, A COMMON HERB OF SOUTHERN EUROPE! IT EXHALES A VOLATILE GAS WHICH EXPLODES WITH A FLASH WHEN IGNITED!

New Appliances



BOILED EGGS without shells are produced by this novel device. Raw eggs are broken into four metal cups, which are closed and lowered into a water container that is heated electrically

JUICE STRAINER
Built into a new extractor, a mechanical strainer oscillates back and forth to force the juice through openings



COCKEYED GLASSES. It's lots of fun to serve drinks at parties in these glasses with crazy stems

TEAPOT DRIP CATCHER. The sponge-rubber bib below keeps tea from dripping and holds the lid on

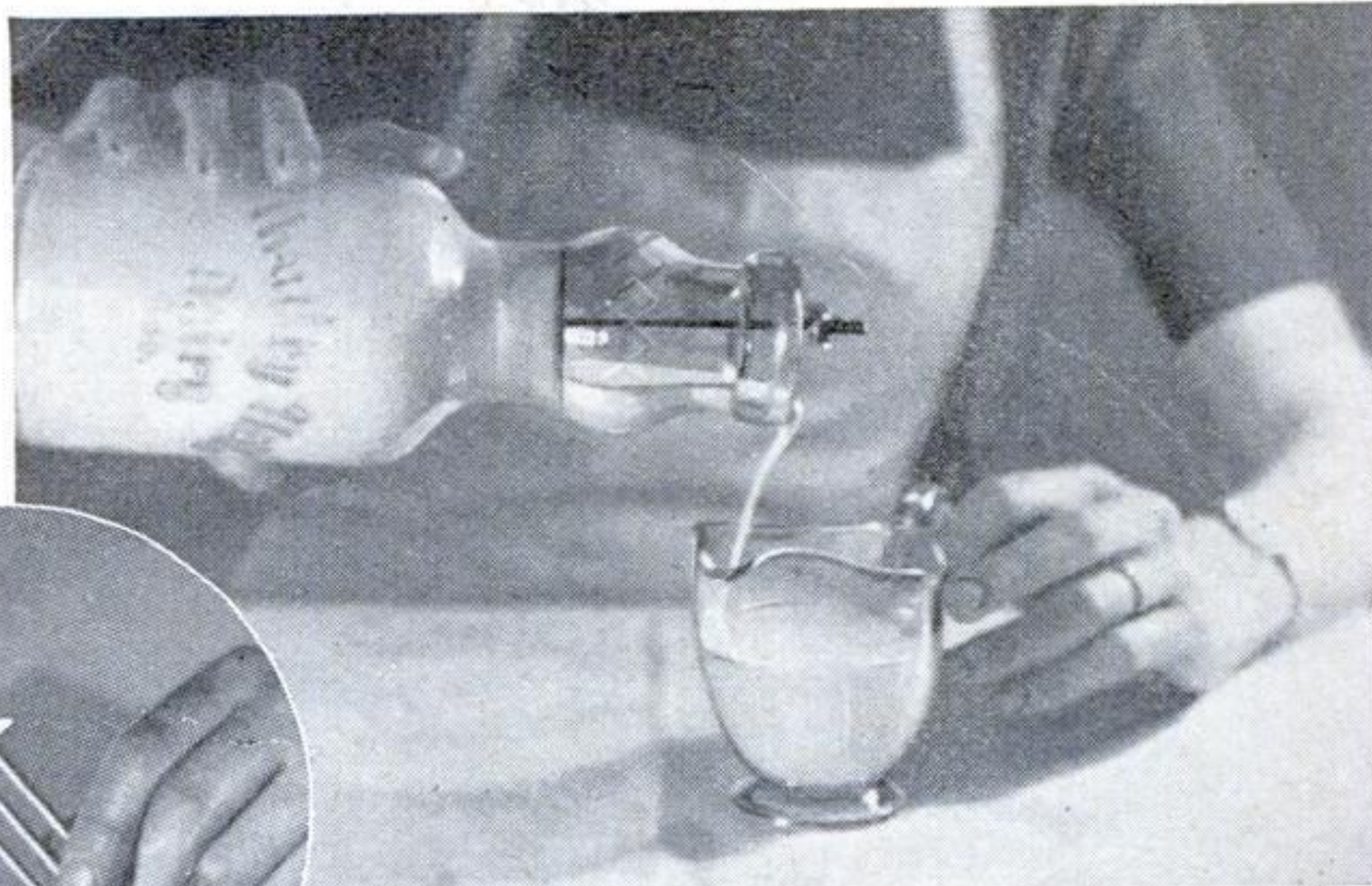


HOME DOUGHNUT FACTORY. With this electrically operated cooker, doughnuts can be made at home just as they are in commercial machines. Temperature of fat is thermostatically controlled. A dough molder is included

Lighten Home Chores



BOTTLE JACKET
Bottled beverages are kept cold in a felt-lined fabric jacket fitted with a slide fastener. It also protects the table cover

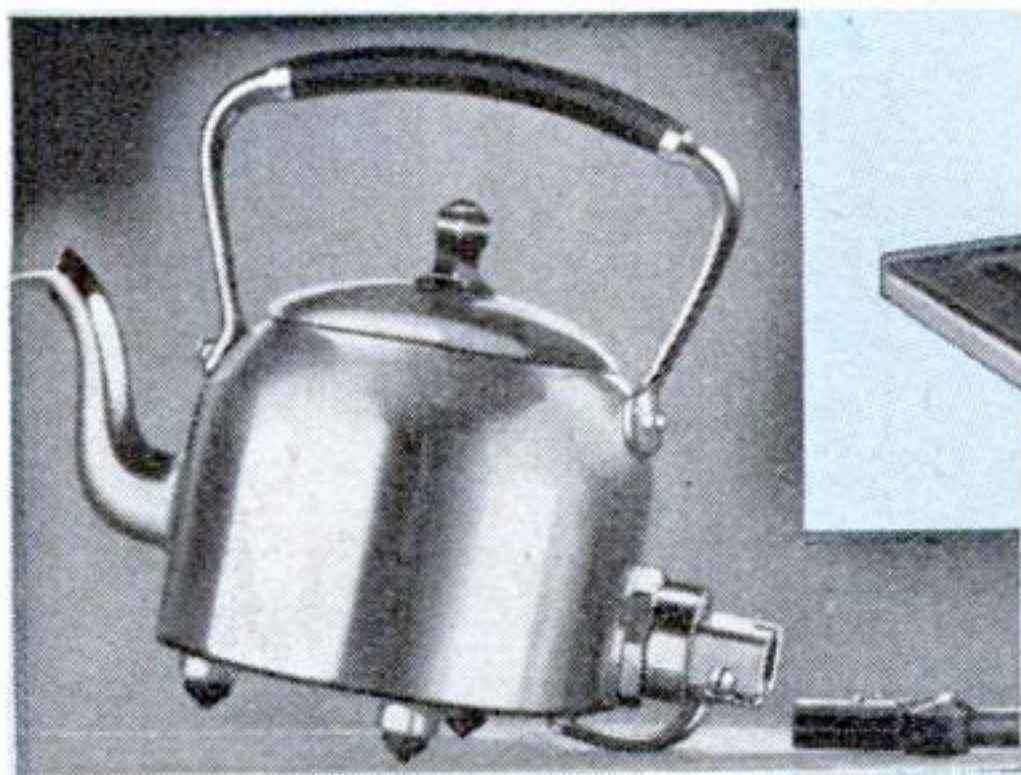


CREAM-SEPARATOR MILK BOTTLE. By inserting a special valve in the enlarged neck of this milk bottle, the user can pour off the cream



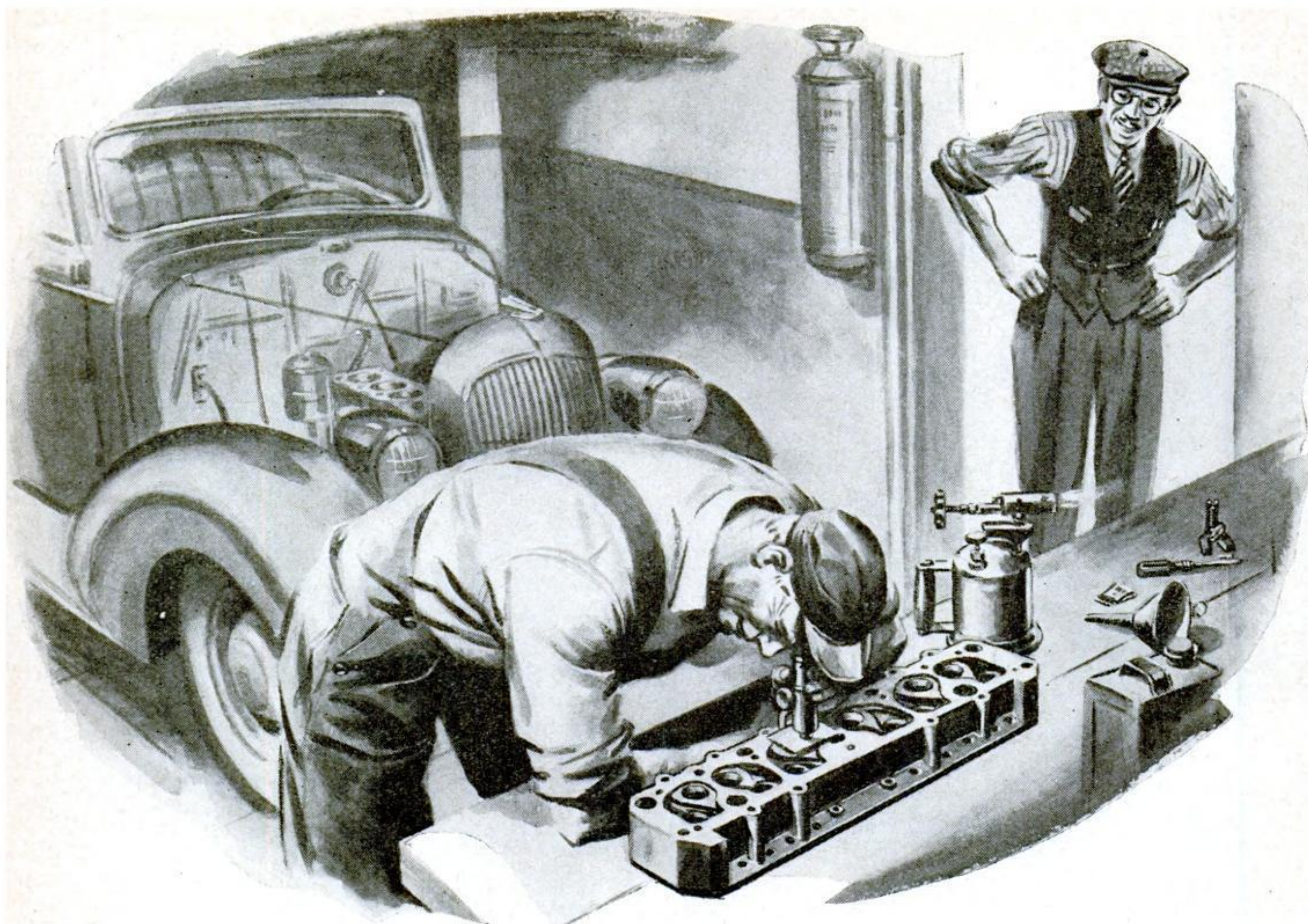
GRAPE JUICE is easily obtained from fresh grapes by putting them in the receptacle at the left, and crushing them

GEARSHIFT STOVE. By moving a lever at the side of the new range at the right, a housewife can slide the oven racks out of the door to remove or examine the food safely



SAFETY TEAKETTLE. When the water level in this electric teakettle becomes dangerously low, it tilts backward and disconnects itself





"What the dickens are you up to?" Joe Clark wanted to know. "I thought you were an automobile mechanic—not a 'bugologist,' or something."

Gus Looks for Trouble

JOE CLARK, hustling out of the office of the Model Garage into the shop where Gus Wilson is boss, stopped dead in his tracks and stared at his partner in surprise.

His surprise was justified. Gus seemed to be engaged in scientific research. He was hunched over his workbench, on which lay an engine head. His right eye apparently was glued to the eyepiece of a microscope, its base and mirror removed, which he held with its stage on the engine head. His other hand gripped a flaming blowtorch. First he'd play the torch's flame on a few inches of the surface of the head; then he'd examine the same section carefully through the microscope. As Joe watched him, he carefully re-examined one of the exhaust-valve seats, let out a grunt of satisfaction, and looked up.

"What the dickens are you up to?" Joe

wanted to know. "I thought that you were an automobile mechanic—not a 'bugologist,' or something. Why the highbrow apparatus?"

Gus grinned at his partner. "Trouble comes in funny places," he said, "and sometimes you have to turn sleuth and track it down. That's what I've been doing for the last three hours—tracking down trouble. I just found it. Come over here; take a look."

He handed Joe the microscope, and indicated the valve seat. "What do you see?" he asked.

Joe squinted through the brass cylinder, and said that he didn't see anything unusual.

"All right," Gus said. "Now wait a minute." He heated the valve seat with the torch flame. "Take another look. Now what do you see?"

Again Joe squinted through the microscope. "Why," he said after a moment, "there's a

small crack, right on the angle of the valve seat. Funny I didn't see it the first time."

"No, it isn't," Gus contradicted him. "Heating the metal makes the crack expand enough for you to see it with the microscope. As a matter of fact, it makes the crack expand enough for water to pass through it from the water jacket. As soon as the metal starts to cool, it contracts enough to close the crack."

"That's a new one on me," Joe said.

"It was a new one on me, too," Gus admitted. "Young Dick Coleman—you know him, Henry Coleman's boy, the one who goes to engineering college—came in this morning with a used roadster he'd bought cheap and partly on time up in Boston. The dealer he got it from must be a real honest guy. He told the kid that the radiator wouldn't hold water for long. He admitted that he'd tried unsuccessfully to find the leak, and told Dick that if he could locate it and fix it up, he could take what the job cost him off his monthly payments.

"Well, Dick's a clever kid with cars, and he thought that finding the trouble would be easy enough, and that maybe fixing it wouldn't be much more difficult.

"He drove the job down from Boston, and had to stop and put water in the radiator every forty or fifty miles. When he got home, he swore that he'd spend his whole vacation, if he had to, trying to find that mysterious leak. There was no trace of water in the crankcase oil pan. He put air pressure on the radiator, but couldn't find any sign of a leak. The gasket on the engine head was good as new.

"So he went to work on the engine itself. He took off the head, washed it with gasoline, and went over it carefully for cracks. Then he put it in a tub of water, boiled it to remove every last trace of grease and oil, and went over it again. Still no cracks. He examined the block, inch by inch. Still nothing doing in the leak line!

"Apparently there was no leak—but the water was going *somewhere*. Naturally enough, young Dick was up a tall tree. So he towed the job around here to the shop, and asked me to take a look at it.

"I know Dick well enough to know that anything he does on a car he does carefully. But I thought that somewhere in the engine head there must be a crack so small that he hadn't seen it—maybe so small that I wouldn't see it, either. So I sent him around to borrow one of Doc Marvin's microscopes—this fifty-power glass that I have here.

"When Dick came back with the microscope, I took off its base and mirror, leaving the stage in place so I could brace it against something solid, and went over every inch of that engine head with it. But I couldn't find any indication of even the smallest crack. And then I was up a tree!

"While I was smoking a pipe and thinking the puzzle over, I remembered something that Dick had told me—that the radiator didn't lose any water while the car was standing in the garage. That gave me an idea—that maybe a crack opened somewhere and let the water leak out only when the engine got hot. So I started heating a few inches of the head's surface with the blowtorch, and then examining it through the microscope before the metal had time to cool off. At last I found the crack I showed you."

"Good work, Sleuth!" Joe applauded. "But what's the answer for Dick?"

"There's only one answer for Dick," Gus said. "A new engine head. He will be able to take what it costs him off the balance that he owes, and when he gets it, he'll have a car that will do him all right for the rest of his time in college."

"Here's another detective job for you, Gus!" Joe Clark called from the office door a couple of hours later. "Mrs. Miller is on the phone, and she says that her car is acting in *such* a funny way! She wants to know if you can fix it for her right now."

"Oh, gosh!" Gus groaned. "That woman! All right, tell her to bring it over."

Mrs. Miller drove into the shop less than ten minutes later, and began to talk before she was halfway out of her sedan.

"Oh, Mr. Wilson," she gushed, "my car is acting in a way that is just too, too mysterious! I'm sure that there must be something dreadful the matter with it. But no matter how bad it is, I know that you'll be able to fix it for me so that I can get over to Pleasantville in time for Mrs. Bunker's tea. I always say to Mr. Miller: 'Henry, I think that Mr. Wilson is just too, too marvelous with machinery!' Why, only the . . ."

Gus managed to edge a few words into the torrent of Mrs. Miller's flood-stage conversation. "Now, this mysterious trouble . . ." he suggested gently.

"Oh, yes—the trouble," she said. "Really, it's too queer for words! The car runs perfectly until I get up to twenty-five miles an hour. *Exactly* twenty-five miles an hour! Then the motor stops, and the car slows down. And then the motor starts again, and runs all right until I again get

**Even If It Takes One of
Those Microscopes That
the "Bugologists" Use,
the Model Garage's Boss
Finds Hidden Car Troubles**

• • •
BY MARTIN BUNN

up to twenty-five. Now, Mr. Wilson, what in the world do you think is the matter?"

"Perhaps we'd better take a little ride down the road," Gus suggested. "You drive, please."

Mrs. Miller succeeded in backing her car out of the shop without hitting anything, and headed down the road. Gus kept his eyes fixed on the needle of the speedometer. It climbed up to twenty-three—twenty-four—twenty-five—

The instant the needle reached the twenty-five mark, the engine quit as if some one had turned off the ignition! The car slowed down. Then, as suddenly as it had stopped pulling, the engine caught hold again, and ran smoothly.

"There!" Mrs. Miller said, triumphantly. "Didn't I tell you!"

"You did!" Gus admitted. "Now, if you'll drive back to the shop, I'll try to find the trouble."

Back in the shop, with Mrs. Miller fidgeting about being late for her tea date and keeping up her ceaseless flow of chatter, Gus carefully checked the car's wiring system. Everything seemed to be in the best of condition.

He was pretty well stumped, and Mrs. Miller was getting badly in his hair. Suddenly, he had a hunch. That speedometer—and the engine always stopping just when the speedometer needle reached the twenty-five-mile mark on the dial. The speedometer must be the key to the mystery of the engine's unusual behavior!

Lifting the hood, he carefully traced the speedometer cable to and through the cowl, and to the dashboard. He noticed that there was a sharp bend in the cable just after it passed through the cowl, and that not more than an eighth of an inch from that bend there was a small spot where the insulation of the "hot" dash wire had been worn through.

He had to stop for water every forty or fifty miles

Gus put down the hood, and got back into the car. "I'll have to ask you to take me for another little ride, Mrs. Miller," he told her. "Yes, I realize that you are in a hurry, but I have to find the trouble before I can fix it!"

Again, Mrs. Miller backed the car out of the shop. When they were on the road Gus crouched forward, with his head half under the cowl. As the car's speed increased, he saw the speedometer cable move very slowly over toward the bare spot in the insulation of the dash wire. "Faster, please," he said. "Up to twenty-five."

As he felt the car's speed increase, he saw the cable move still closer to the worn insulation. Suddenly there was a flash, and the engine quit. As the car slowed down, the

cable began to move back toward its original position. Then there was another spark, and the engine began to fire evenly again.

Gus withdrew his head from under the cowl, straightened up, and laughed as he looked at Mrs. Miller. "That one had me stopped for a while," he said. "Stopped dead! Don't bother driving me into the shop. I can take this bug out in half a minute, and you'll be in plenty of time for your tea party."

"You're so wonderful with automobiles, Mr. Wilson!" Mrs. Miller enthused. "But do tell me just what is the trouble that it took you so long to find, and that you will be able to fix so quickly."

Gus groaned—mentally. "Well," he started to explain, "you know, of course, how a speedometer works. The cable . . ."

"Oh, yes—the speedometer!" Mrs. Miller was bright, if vague. "Yes, I know about that—it tells you how fast you're going."

"Yes," Gus said. "Yes. Well, the cable has—do you know, Mrs. Miller, I think it would be better if I fixed *(Continued on page 230)*

GUS SAYS:

Most people do a lot of long-distance driving during the summer. That's fine for everybody, but what's the fun of tiring yourself out by trying to turn a nice two-day trip into a one-day race? Stop before you're tired, and rest. Then go on next day. You'll drive better and have a much safer trip.



The Home Workshop



In This Issue... SAIL MAKING • SHOP SHORT CUTS
• MODEL OF THE NEW "MAURETANIA" • PHOTO HINTS



THE NEW TRANSATLANTIC LINER

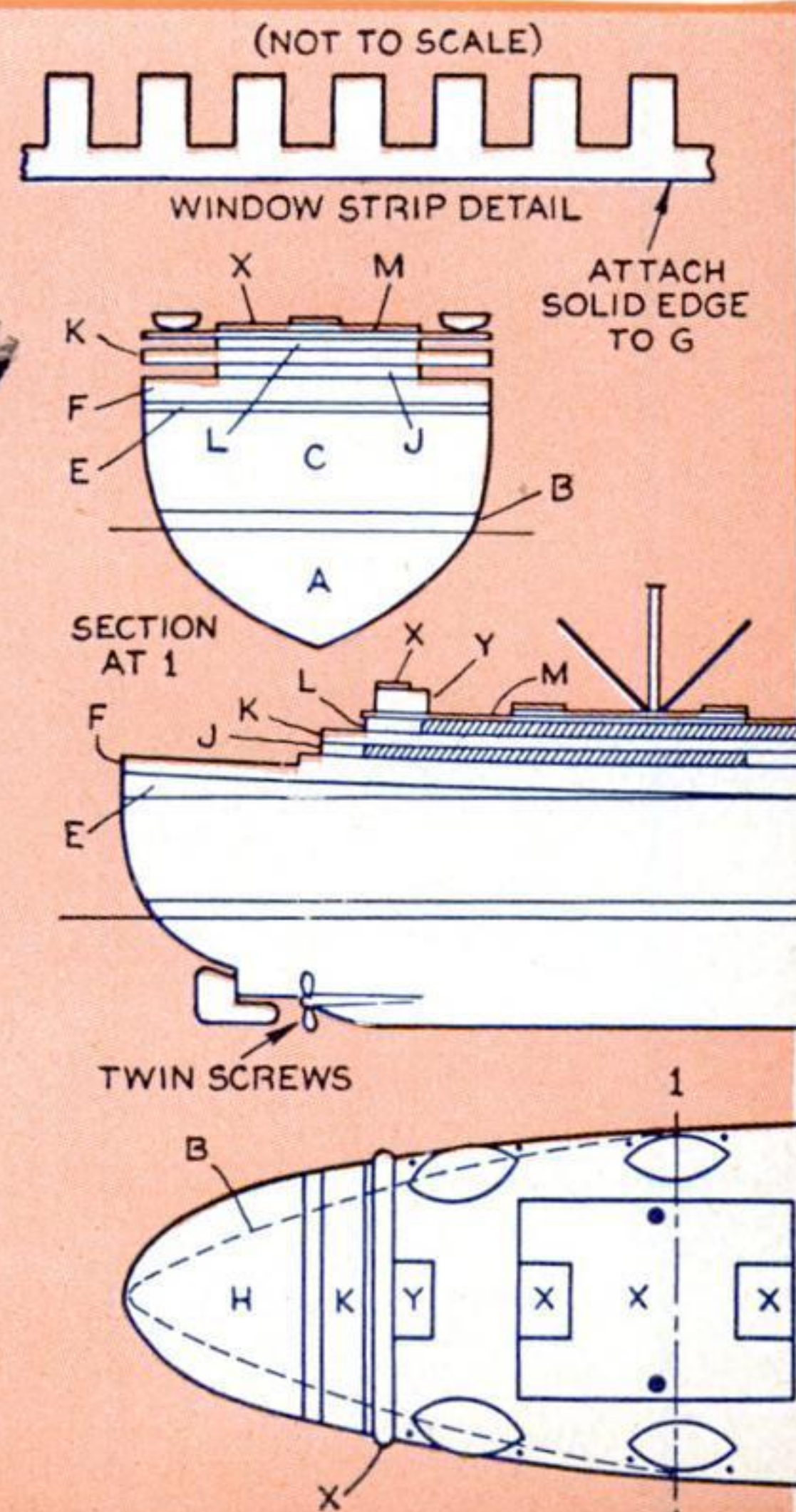
Mauretania



The model is $7\frac{5}{8}$ " long but could be made bigger. This new liner is the largest to make her maiden trip in 1939

A Miniature Model
Designed Especially
for the POPULAR SCIENCE
MODEL-of-the-MONTH CLUB

By
**THEODORE
GOMMI**

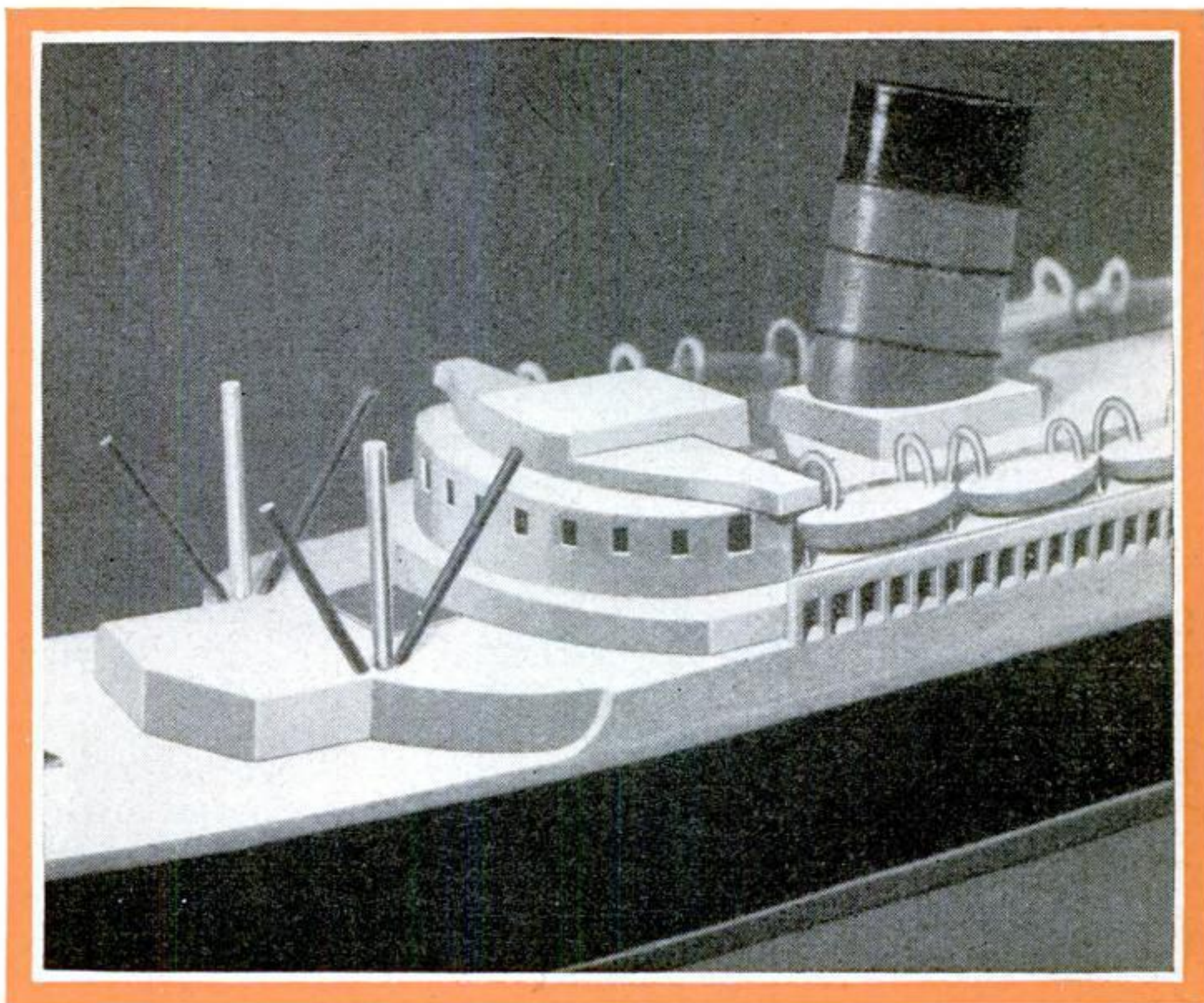


AS THIS issue goes to press, the new Cunarder *Mauretania*, the largest ship to be completed in 1939, is running her speed trials preparatory to entry in the transatlantic service. Her name, needless to say, is already famous in the annals of ocean steamships for the extraordinary performances of the first *Mauretania*, which held the blue ribbon for more than twenty years. Looking at the beautiful lines of the new ship and remembering all the progress in shipbuilding since her predecessor was launched, one feels that the new *Mauretania* will carry her famous name with honor and maintain the high prestige of the Cunard Line on the Atlantic.

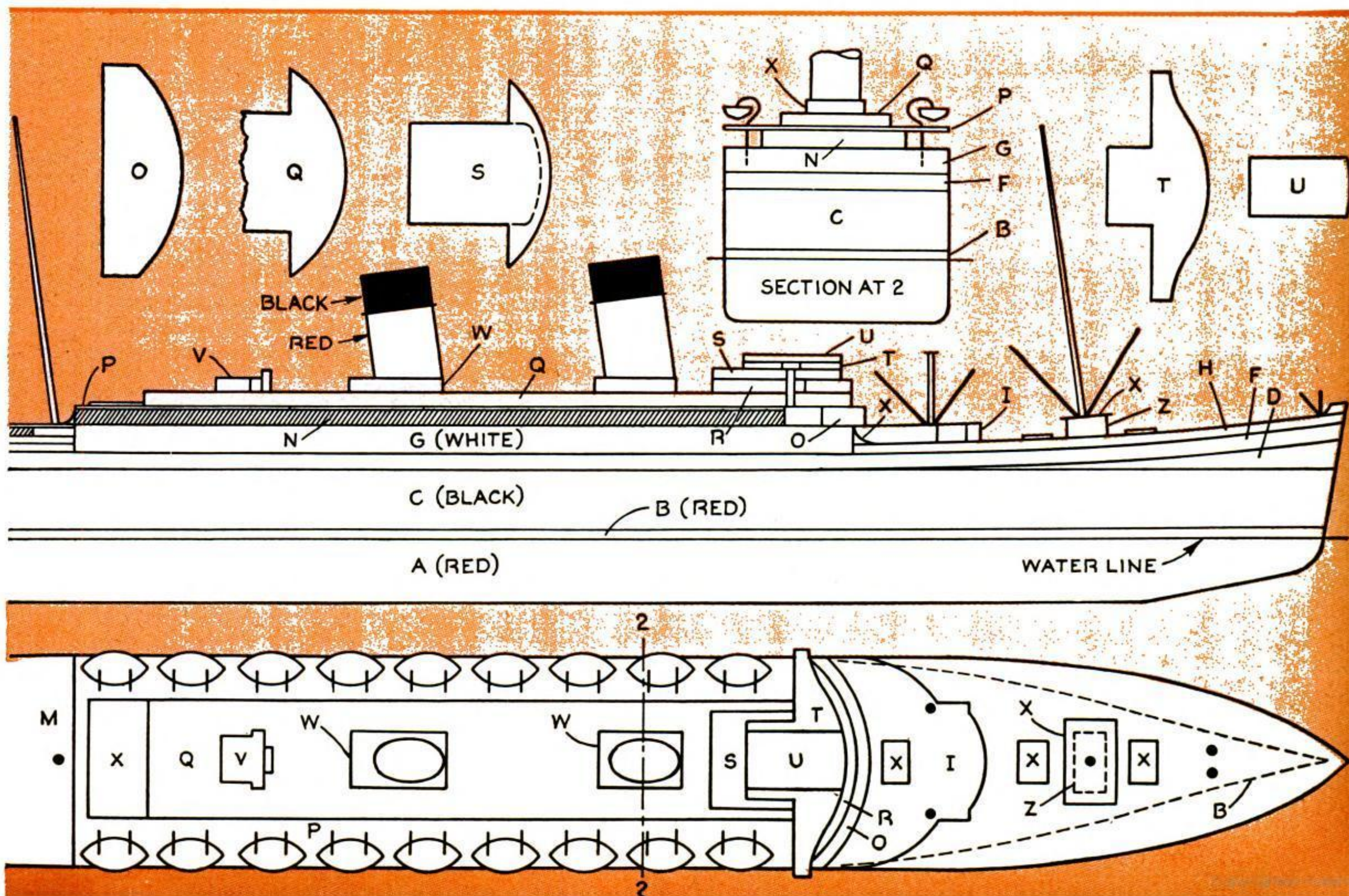
We are indebted to the Naval Architects Department of Cunard-White Star, Ltd., for the plans of the ship on which our model is based. The scale is 1" equals 100' as in previous models of this series; however, a larger model may be made by doubling all the dimensions given. The drawings below are full size and show how the model is built up by our usual method of using thin wooden layers. The various small details

are indicated on the drawings and also shown clearly in the photographs.

If a full hull model is desired, *A* and *B* can be one piece of wood; and, in fact, anyone adept at carving can shape the entire hull up to *F'* out of one block. The superstructure is easily assembled after cutting all wood and paper to the shapes shown in the plan. The layers that do not come out to the side of the ship are represented by shading



A close-up showing bridge, forward funnel, lifeboats, and window strip



in the side elevation. These are set in $\frac{3}{16}$ ".

The beginner may omit the suspended lifeboats and the window strip, if he finds the task too tedious, without seriously affecting

LIST OF MATERIALS

WHITE PINE, BASSWOOD, OR Balsa

No. Pc.	T.	W.	L.	For
2	$\frac{1}{4}$	1	8	A and C
1	$\frac{1}{8}$	1	8	D and G
4	$\frac{1}{16}$	1	8	F, E, I, N, O, Q, R, V, W, Y, Z
3	$\frac{1}{32}$	1	8	B, E, H, J, K, L, S, T, U
1	$\frac{5}{16}$	$\frac{1}{8}$	8	Lifeboats

MISCELLANEOUS

2 pc. thin, stiff card or Bristol board 1" by 8" for P, M, all X items, window strip, and rudder.

2 thin needles $1\frac{3}{4}$ " long for masts.

4 small pins ($\frac{1}{2}$ ") for posts.

2 small pins ($\frac{3}{4}$ ") for screws (propellers).

Thin, stiff wire for booms, davits, etc.

2 pc. aluminum tubing $\frac{5}{16}$ " round by $\frac{5}{8}$ " long for funnels.

No. 100 black cotton thread and No. 100 white cotton thread.

Black, white, brown, and red paint.

Note: All dimensions are give in inches. Piece A and the rudder and screws are not required for a water line model. The width of 1" is nominal; actually the width of the model is $\frac{15}{16}$ ", but the reduction in size will be taken care of by the sandpapering necessary to shape the hull and superstructure.

the appearance of the model. In that case all the lifeboats should be attached directly to deck P.

The funnels are cut from aluminum tubing which has been pressed to the desired oval shape. The masts, derrick booms, posts, and similar parts should all be painted before assembly, then inserted into drilled holes.

The underwater portion of the hull is painted bright red. The hull from C to F is dull black. The hull above F and the entire superstructure is painted flat white. The masts, derrick booms, and hatch covers are a light brown, while the posts are white. The funnels are bright red with black tops. The two thin stripes on the funnels are best shown by loops of No. 100 black cotton thread. Since these stripes are a beading in the prototype, there is no objection to the raised thread.

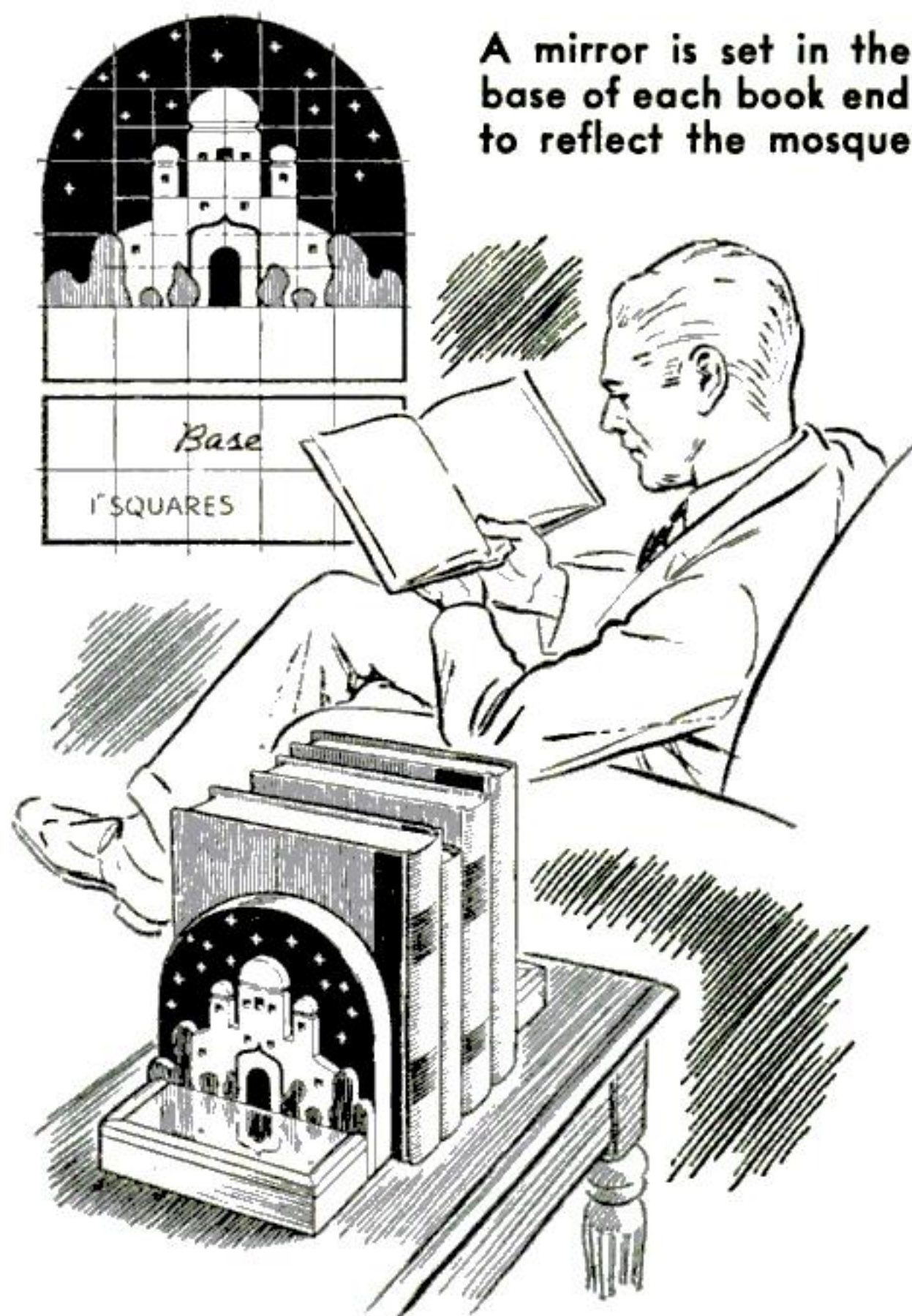
If the window strip is used, piece G should be slightly narrower than F and P to allow for the thickness of the paper. The "teeth" of the strip should just touch the underside edge of P. In making the davits, allow sufficient length of wire so that the ends can be inserted in holes drilled in G after passing through P. The shape of the davits is shown in the cross section marked No. 2. Insert the davits before fastening the window strip. The boats are then attached to the davits with drops of glue. A very fine (No. 80) drill is indispensable for this work.

Mosques and Mirror Lakes Decorate These Book Ends

IN THESE unusual book ends a small mirror forms a clear pool in the foreground and gives a sparkling reflection of the white mosque silhouetted against a dark, star-studded sky. Cut the two bases and the two rounded blocks from 1" wood. Jig-saw the two mosque shapes from $\frac{1}{8}$ " wood and glue them to the end blocks.

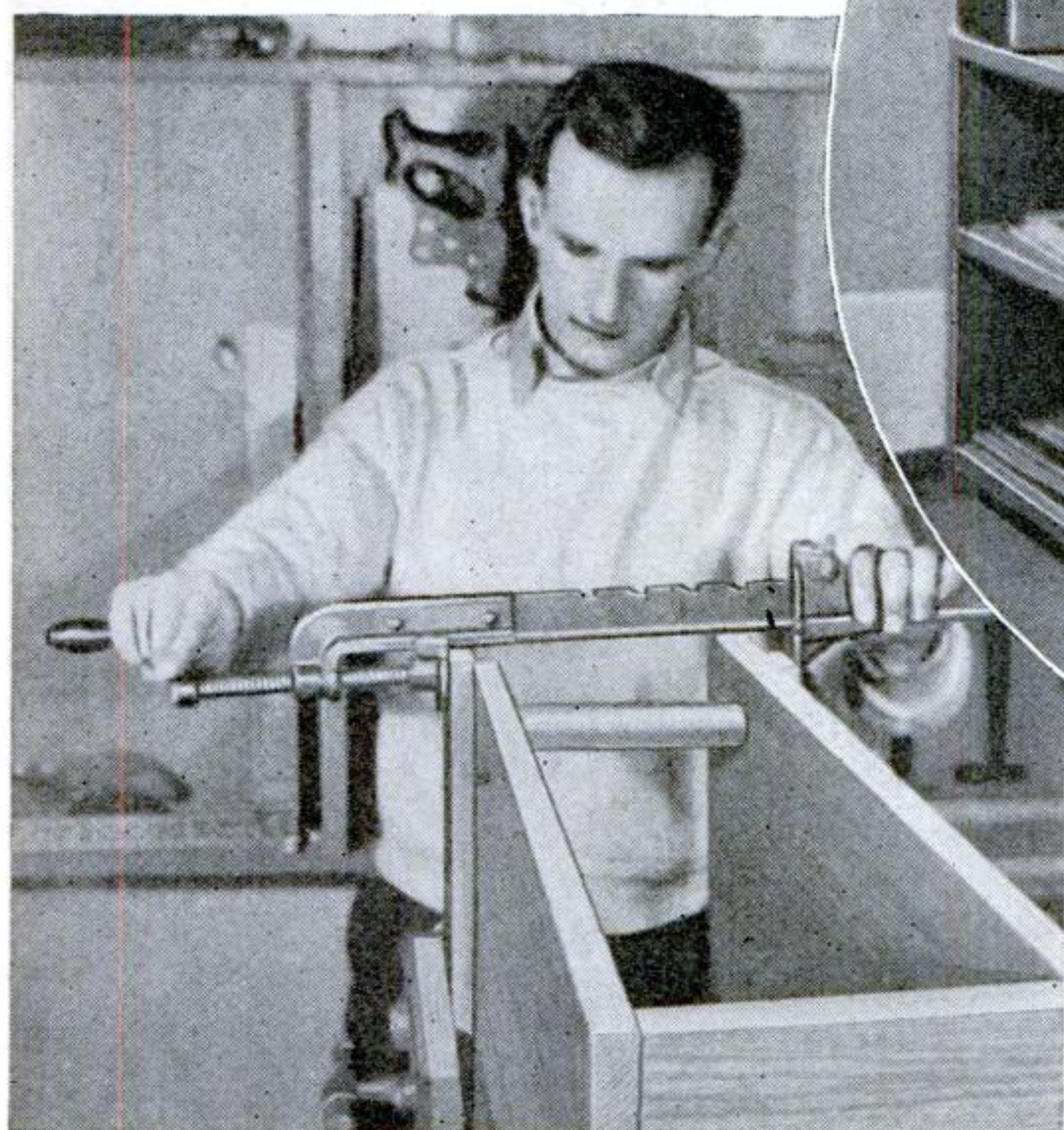
Cut two pieces of mirror glass $\frac{1}{2}$ " shorter and $\frac{1}{4}$ " narrower than the bases, and make a tiny frame to fasten to the base around each mirror. Assemble the book ends with glue and slender brads. Undercutting the bases and filling the hollows with melted lead will give extra weight to the book ends for holding extra heavy books.

Enamel the sky midnight blue with white stars, the mosque white with tan windows and lines and a tan door, the trees dark green, and all the other surfaces of the book ends silvery gray.—HAZEL F. SHOWALTER.



A mirror is set in the base of each book end to reflect the mosque

STURDILY BUILT End Table OF MODERN DESIGN



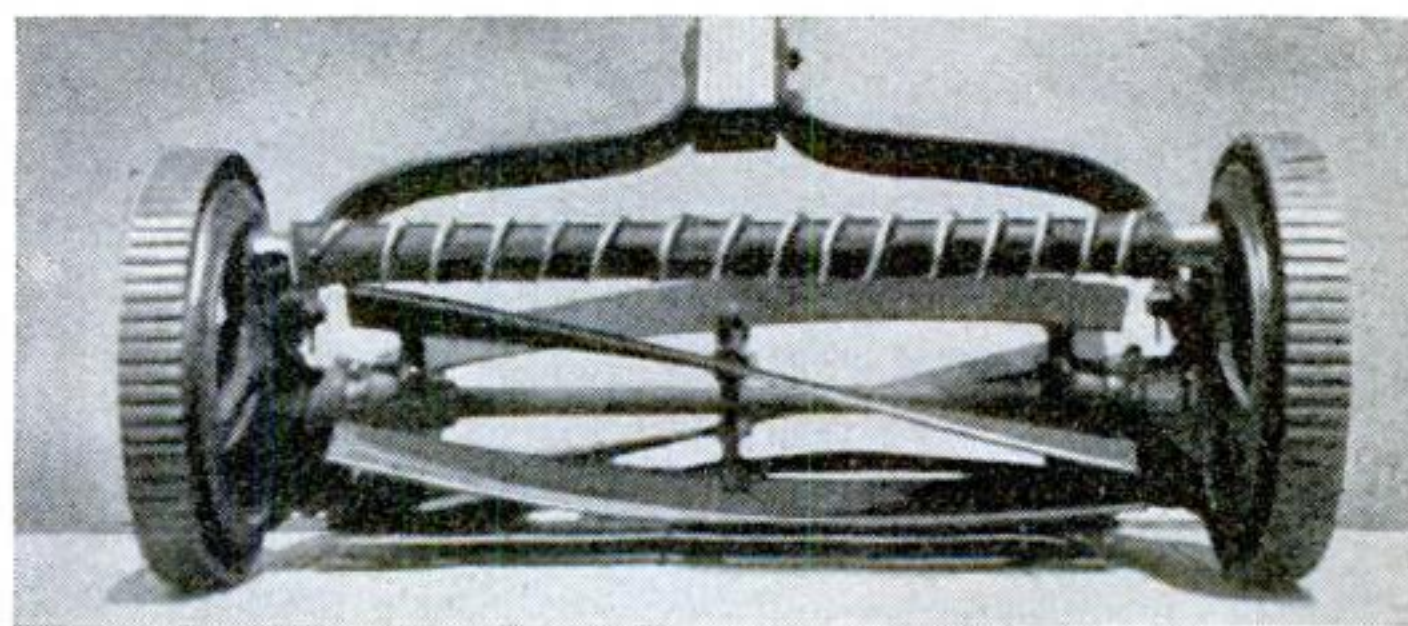
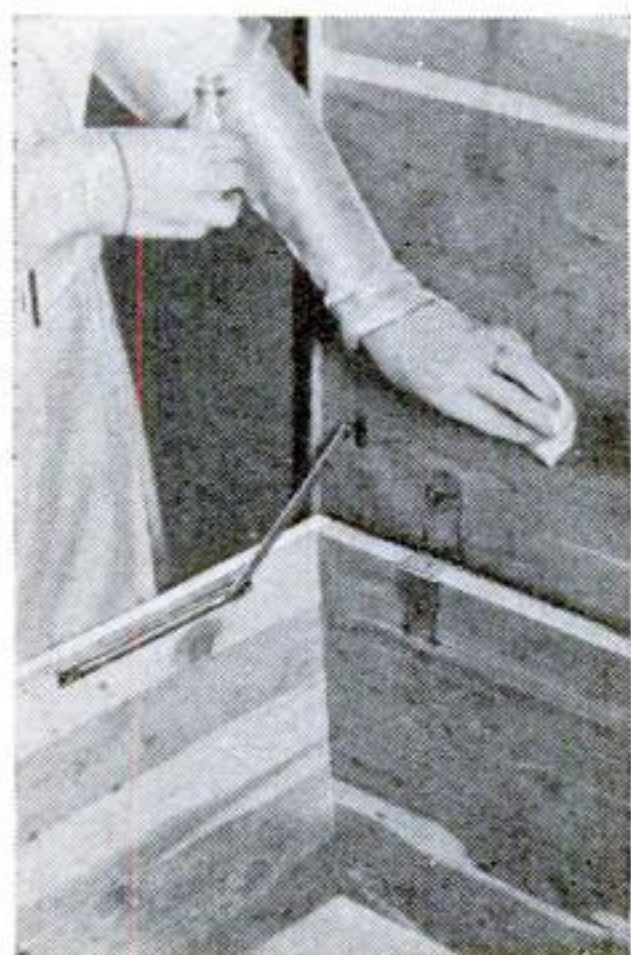
This handy end table consists merely of four wide boards, two narrow rear uprights, two round front posts, two long round feet, and a back of plywood

The construction is of the simplest variety. The joints between the top and the end pieces are doweled, and the middle and bottom shelves are fastened with screws. The plywood backing is bradded into rabbets. The two round supports are $1\frac{1}{2}$ " in diameter and doweled top and bottom. The feet are pieces of the same stock, slightly flattened lengthwise, and screwed under the bottom shelf of the table.—GEORGE E. BASICH.

MADE of red gumwood, this modern end table solves the problem of where to put magazines, books, a small radio set, smoking accessories, and other knickknacks. It was made of 12" wide boards and is 35" long, but the dimensions should be adapted to suit the chair beside which it is to stand.

Reviving an Old Cedar Chest

CEDAR chests that have lost most of their characteristic aroma can be revived by applying a few drops of oil of cedar to the interior surfaces and rubbing them in well with a soft cloth. Close the chest for a short time before putting in any clothes so that the wood will have a chance to absorb all the oil. This treatment can be renewed from time to time as necessary, but don't overload the wood with the oil or it might stain the clothes.—R. D. M.



Rubber-Padded Lawn Mower

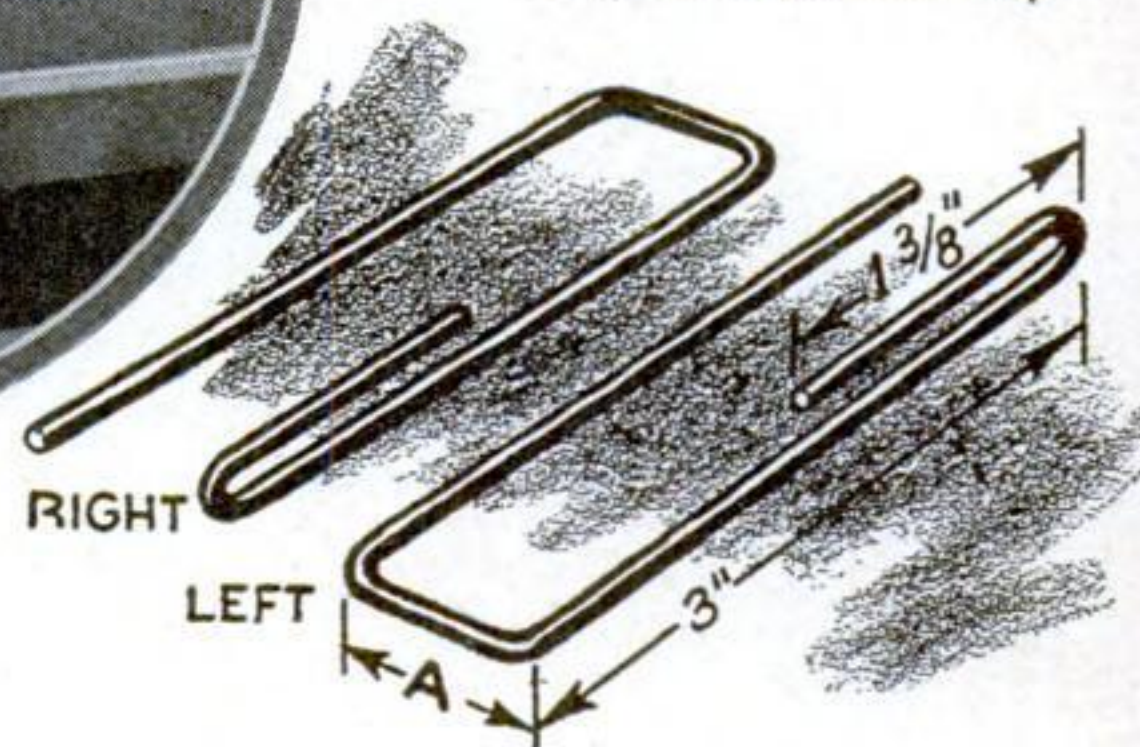
A PIECE of discarded garden hose attached to the cross brace of your lawn mower will help protect young trees and shrubs from being injured. The hose should be cut somewhat longer than the width of the mower. Run a dowel inside to form a backing, and use a sharp knife or hack saw to sever the hose spirally. After removing the dowel, put the hose over the brace and bind both ends.

Wire Clips Adjust Venetian Blinds



With wire clips bent as shown below and applied as at the left, a Venetian blind can be adjusted so any part remains open while the rest is closed

WIDTH "A" FOR
2" SLAT..... $1\frac{1}{4}$ "
 $1\frac{3}{4}$ " SLAT.....1"
 $1\frac{3}{8}$ " SLAT..... $\frac{3}{4}$ "

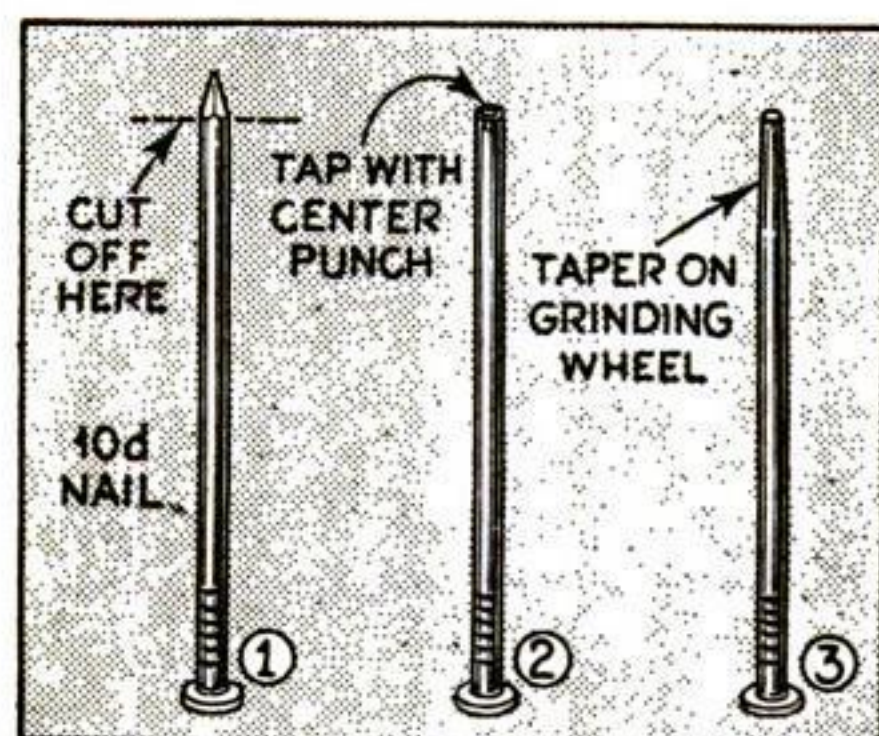
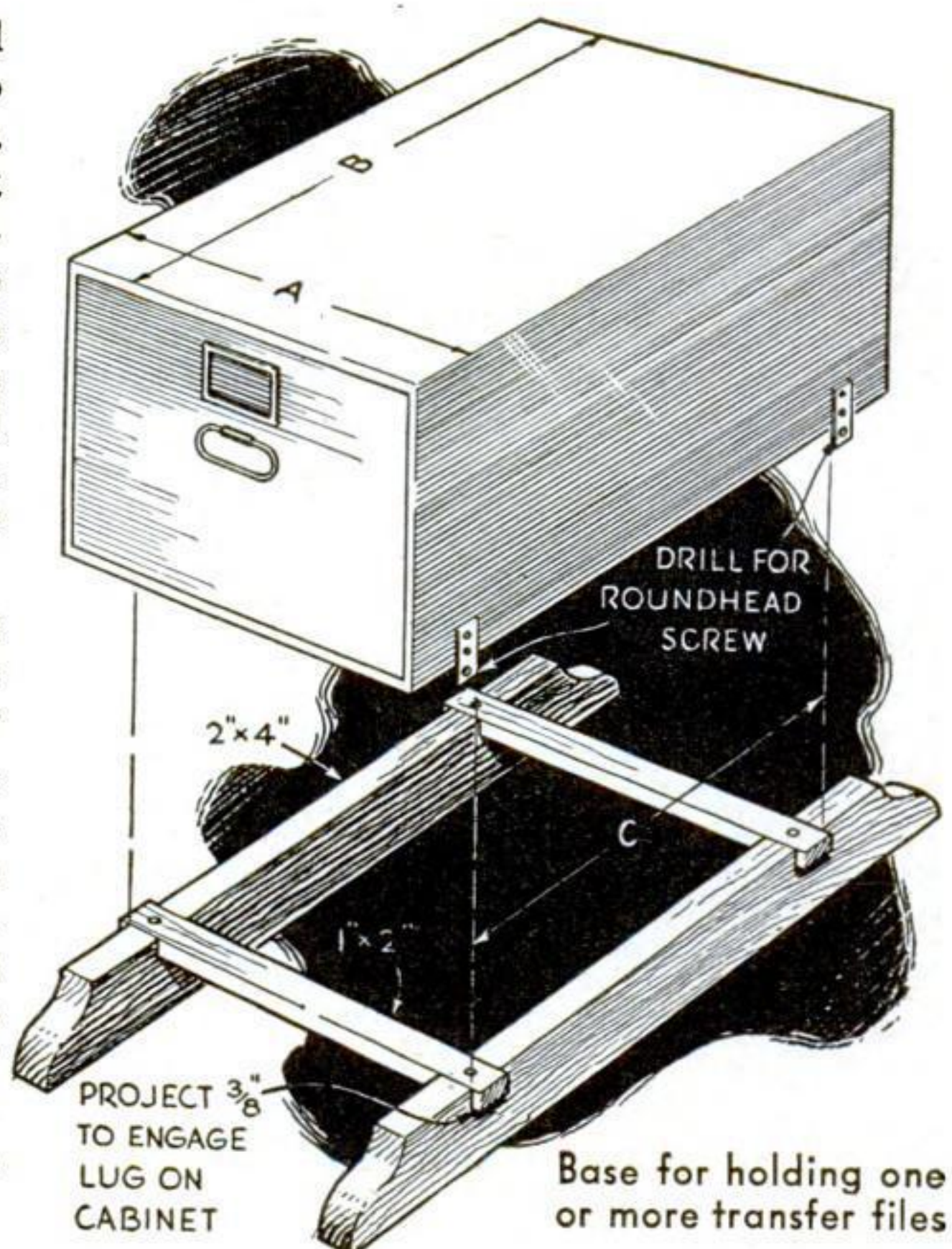


EVEN with the latest refinements, Venetian blinds are not completely adaptable to every need for light and ventilation. However, by making a set of wire clips as shown from a wire clothes hanger, any blind may be adjusted so as to have any part of the top or bottom open for ventilation while the remainder of the blind is closed to exclude the dazzling sunlight.—DON R. FOSLER.

Base for Mounting a Transfer File

WHEN a so-called "transfer file" has to be used in place of a regular filing cabinet in order to save expense, it pays to make a wooden base of the type illustrated. The size of the base will depend upon dimensions A, B, and C of the transfer file.

Mounted in this way, the file will be found adequate for use in the home or a small shop, or in a temporary office, such as on a construction job. Four of the drawer units can be stacked, one on top of the other, like a regular filing cabinet.—GEORGE M. CLARK.



Making Nail Set in an Emergency

IN AN emergency a nail set can be made in a few minutes from a tenpenny or other large nail. Cut off the point with hack saw or grinding wheel, clamp the nail in the vise, indent the end by tapping it with a center punch, and taper or bevel the end on the grinding wheel as shown.—ALBERT W. STEIN.

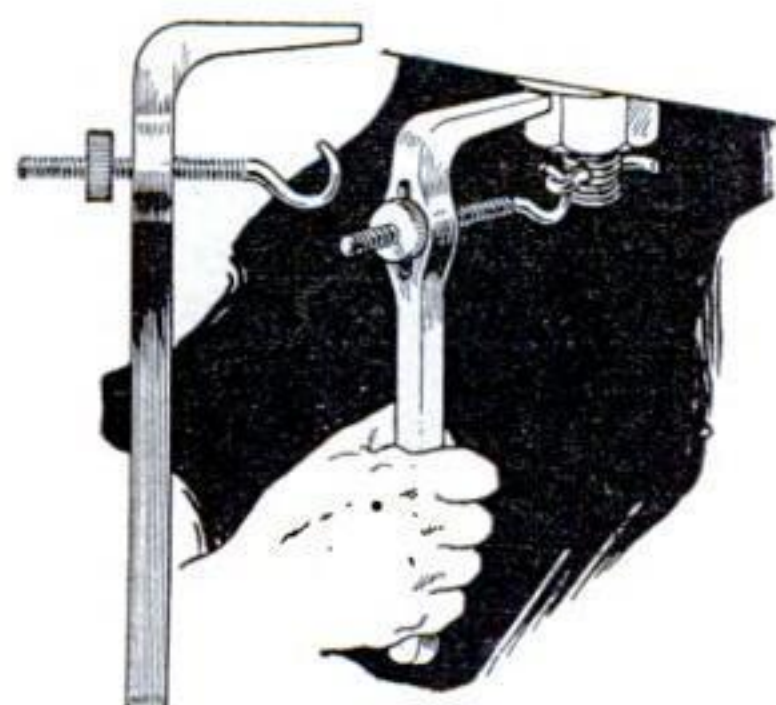


Steel Wool and Furnace Cement Repair Cracked Castings

MANY large cracks and breaks in cast-iron furnaces and stoves can be repaired by using coarse steel wool in combination with furnace cement. The cracks or opening are stuffed with the steel wool, then the furnace cement is worked in thoroughly. The steel wool will even hold a broken part in place while the cement is being applied; furthermore, should the cement shrink and crack at any time, the strands of steel will retain it in position and prevent the broken piece from falling out. Steel wool makes an excellent foundation for iron cement, asbestos cement, stove cement, or any other semiplastic material while being applied and drying. This expedient is particularly valuable for patching up old stoves and furnaces that have gaping holes caused by rust and breakage.—IRVING H. HEGEMAN.

Strong Cotter-Pin Puller

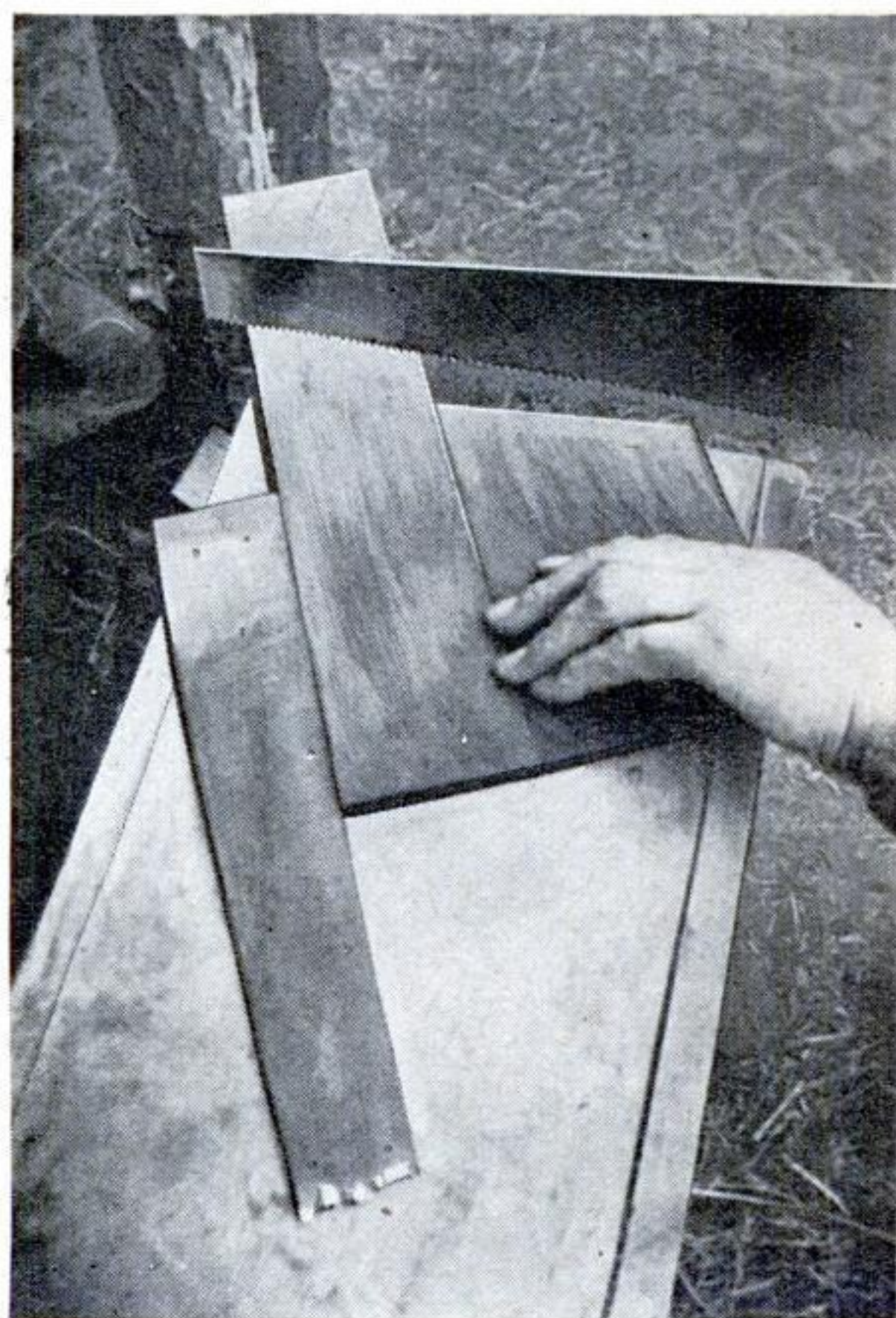
EVEN large and stubborn cotter keys cannot resist the persuasion of the unusually powerful puller illustrated. It should be made from a good grade of tool steel. The lever is bent as indicated, and a slot is made in it through which the adjustable



screw hook is inserted. In use, the hook is entered in the eye of the cotter and the thumb nut screwed up until suitable leverage may be obtained. As the cotter is pulled, the nut is screwed up more to give better leverage.—CHARLES H. WILLEY.

Very Small Nails Started with Aid of Bobby Pin

WHEN very small finishing nails or brads have to be started in hardwood, one's thumb and finger are often in the way of the hammer, yet it is quite difficult to press the points far enough into the wood to make the brads stay in place until they can be given the first tap. In such cases, a common bobby pin may be used as a holder. It will grip the nails more securely than a pair of tweezers, and with it the smallest brad can be placed exactly where needed. The brad is gripped near the open end of the bobby pin.

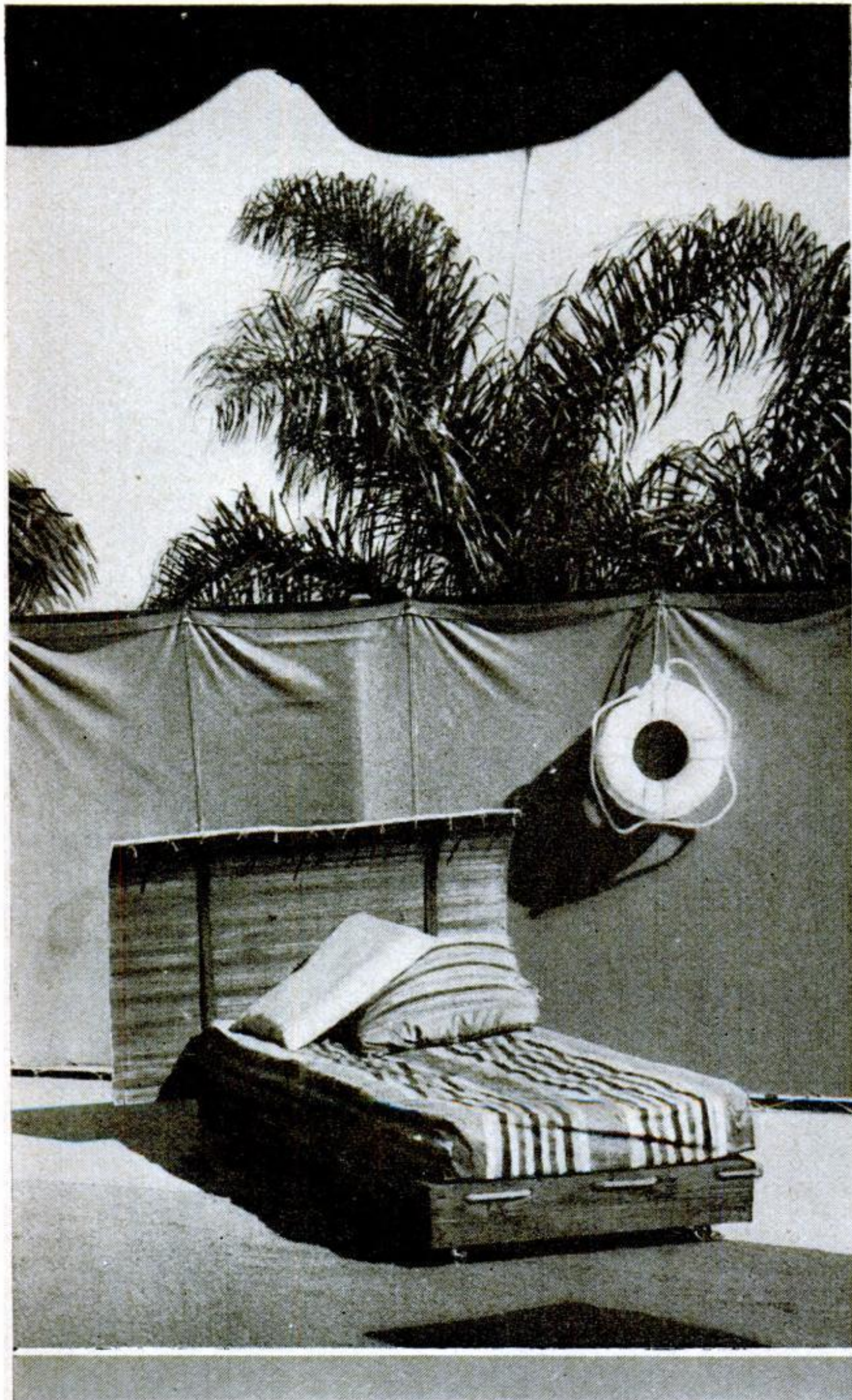


Shingles Quickly Cut to Fit Under Gable

IF A NUMBER of wood shingles have to be cut at an angle—as, for example, to fit under the gable end of a roof—time can be saved by nailing a strip of lath or a board on the end of the bench as illustrated above. The shingles are placed against this simple jig and the unwanted ends are then merely cut off square with the edge of the bench as required.—N. W.

Marine Sun Deck

BUILT ATOP A FLAT-ROOFED GARAGE



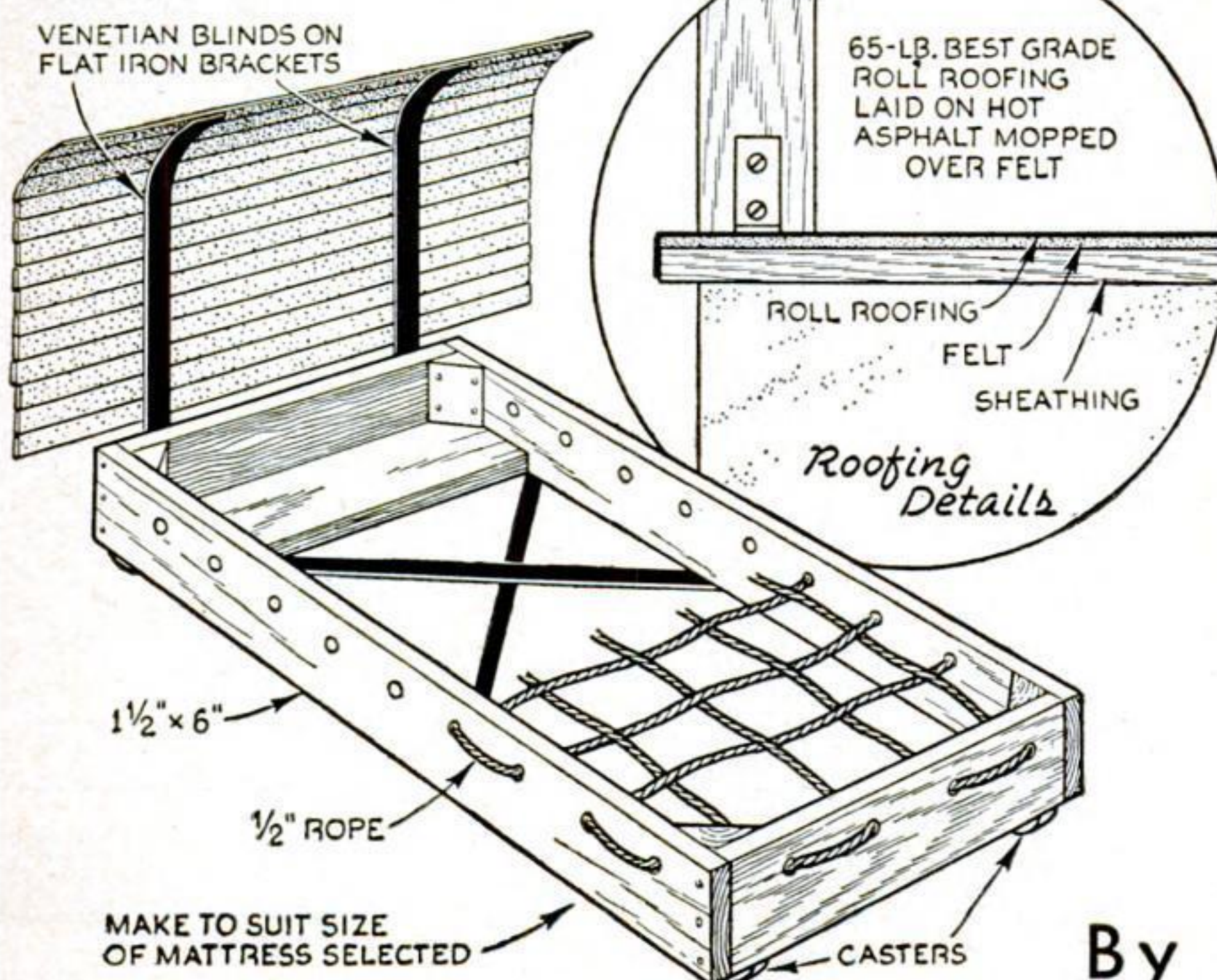
SHOULD your garage happen to be of the flat-topped variety, you can convert the roof at moderate expense into an attractive sun deck. It will give you a comfortable and comparatively private place to lounge in, and you won't have to stir a stone's throw from your own home to enjoy it.

Possibly the roofing already on the garage will bear walking upon, but if there is any doubt, cover it with 20-oz. canvas. A new garage can, of course, have its roof constructed for this purpose. One good method is to tack a layer or two of building felt over the roof sheathing boards and mop the surface with hot tar or asphalt, and upon this lay the best grade of 65- or 75-lb. roll roofing. It is assumed that the roof is well supported below so that there will be no sagging to cause a depression in the middle that will catch and hold rain water.

If you are inclined to go to the extra expense, a dark brown linoleum over the roofing will be attractive, especially if inlaid with a "compass card" design or if such a design is painted over it in bright colors.

The frames for the canvas windbreak shown in the accompanying illustrations are of wood, but galvanized iron pipe can be used instead, although somewhat more expensive. The wooden uprights, which are an-

VENETIAN BLINDS ON
FLAT IRON BRACKETS



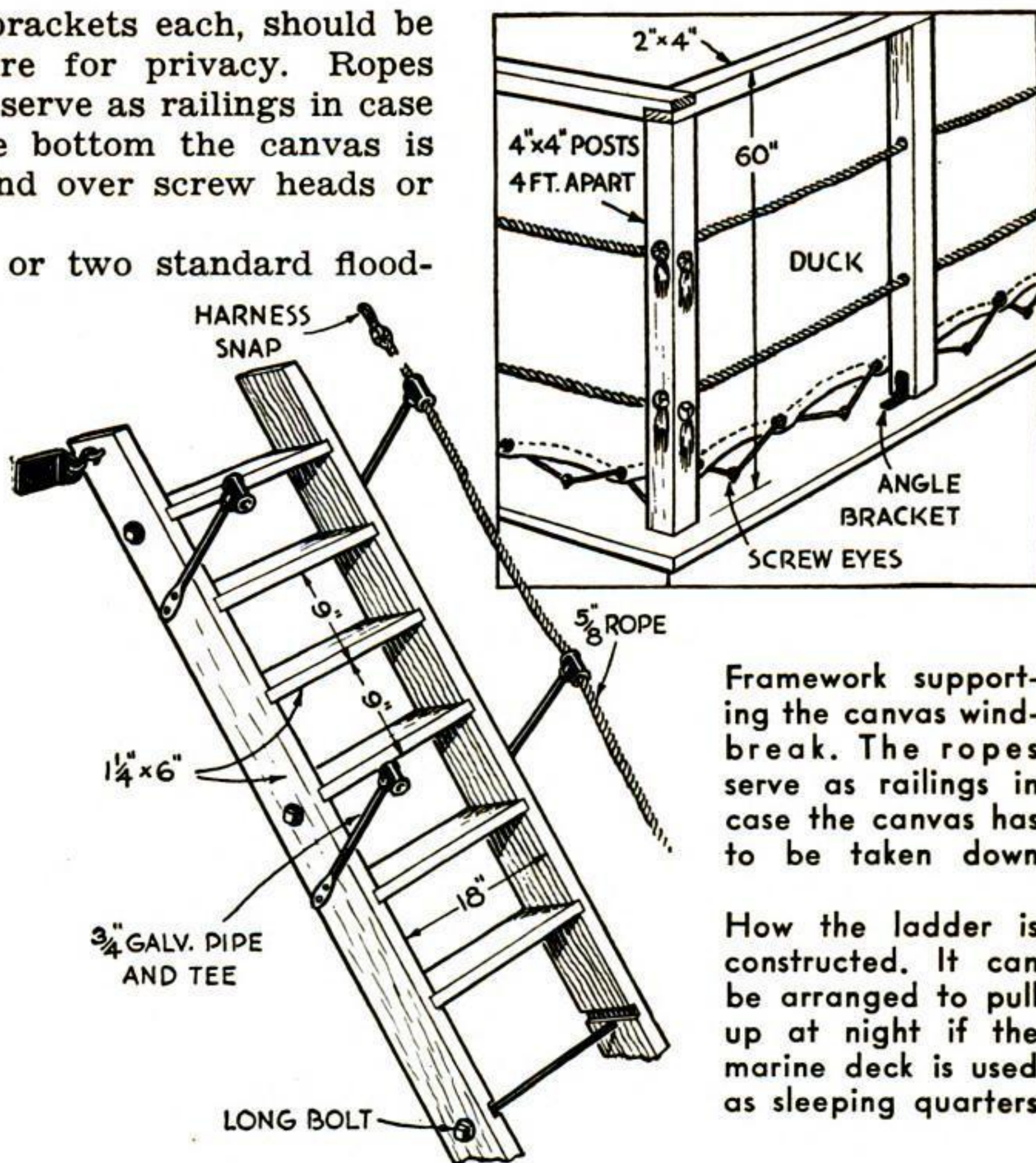
By **HI SIBLEY**

chored with two galvanized angle brackets each, should be carried up as high as you require for privacy. Ropes threaded through holes in the posts serve as railings in case the canvas is taken down. At the bottom the canvas is laced to screw eyes in the floor, and over screw heads or hooks along the top rail.

Illumination is provided by one or two standard flood-light hoods such as are used in gardens, and at the entrance a bulb is wired in a bosun's or other suitable lantern. A ship's bell carries out the marine motif.

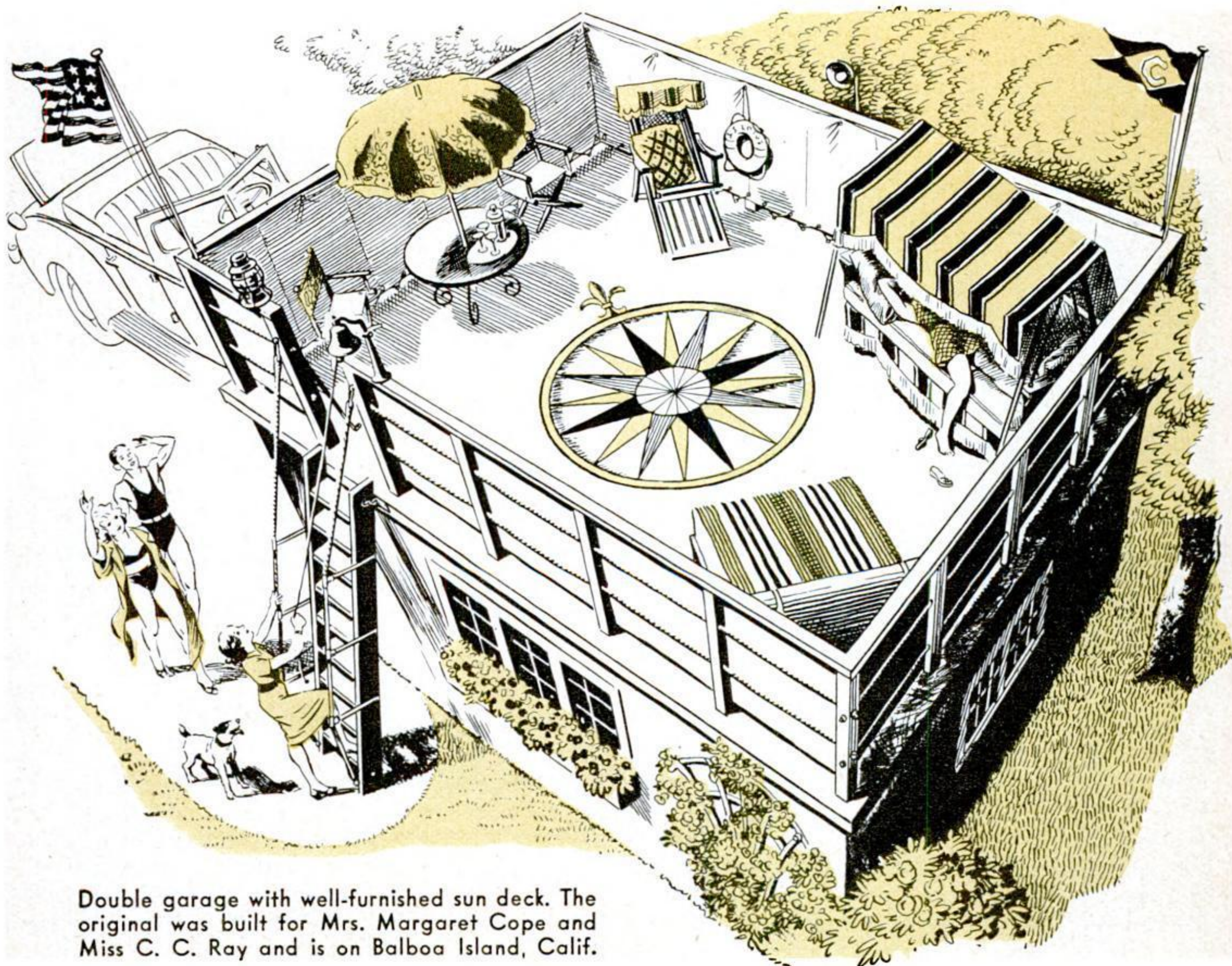
Access to the sun deck is by a ship's ladder with rope rails. This can easily be arranged for pulling up at night or removing entirely when the family is away.

This deck is not only a pleasant retreat on a lazy afternoon, but it can be used at night as a sleeping place. It is especially useful when there are emergency guests. Two or three sun couches, built as illustrated, can be used day or night. Each is merely a wooden frame laced with rope to support a pad or mattress. An iron frame at one end supports a sunshade.



Framework supporting the canvas wind-break. The ropes serve as railings in case the canvas has to be taken down

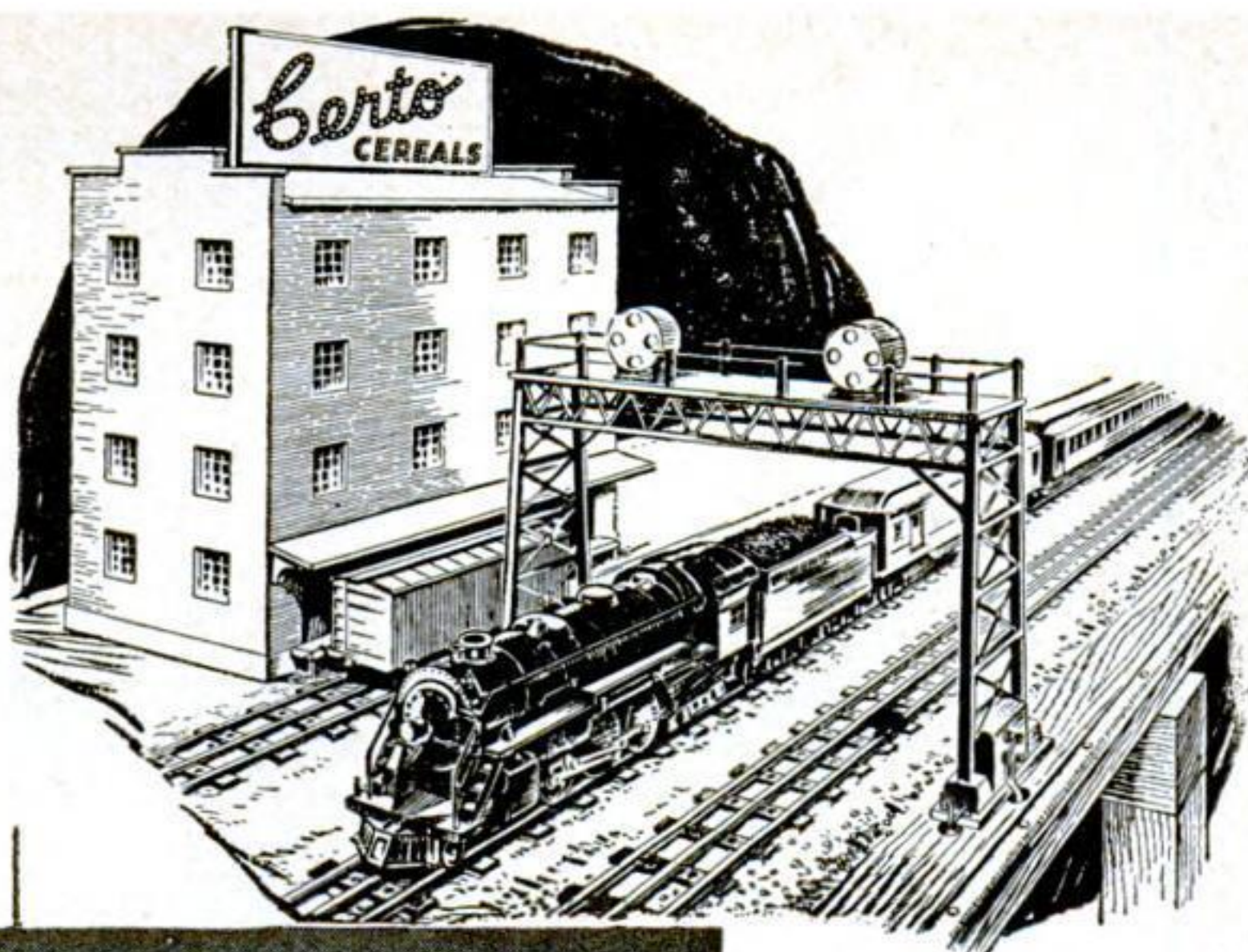
How the ladder is constructed. It can be arranged to pull up at night if the marine deck is used as sleeping quarters



Double garage with well-furnished sun deck. The original was built for Mrs. Margaret Cope and Miss C. C. Ray and is on Balboa Island, Calif.

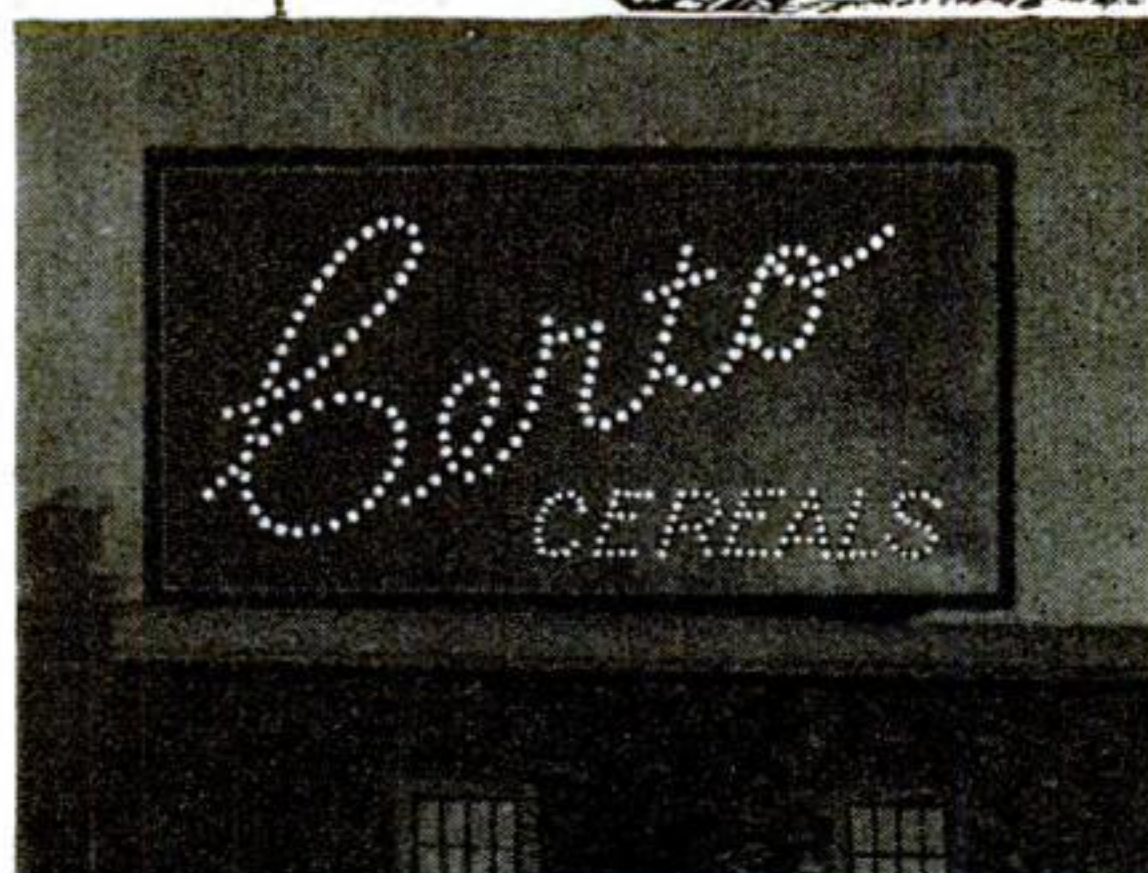
Illuminated SIGNS

ADD SPARKLE TO A Model Railway Layout



MINIATURE neon and flashing signs can be easily made up and included as a part of the scenic effect of your model railroad system. They add much to the realism of factory or commercial buildings, especially when illuminated at night.

In the popular type of flasher sign, the miniature light bulbs are actually pinholes made in the sign and illuminated with two or three small light bulbs placed in a tin reflector at the back. It may be necessary to back the

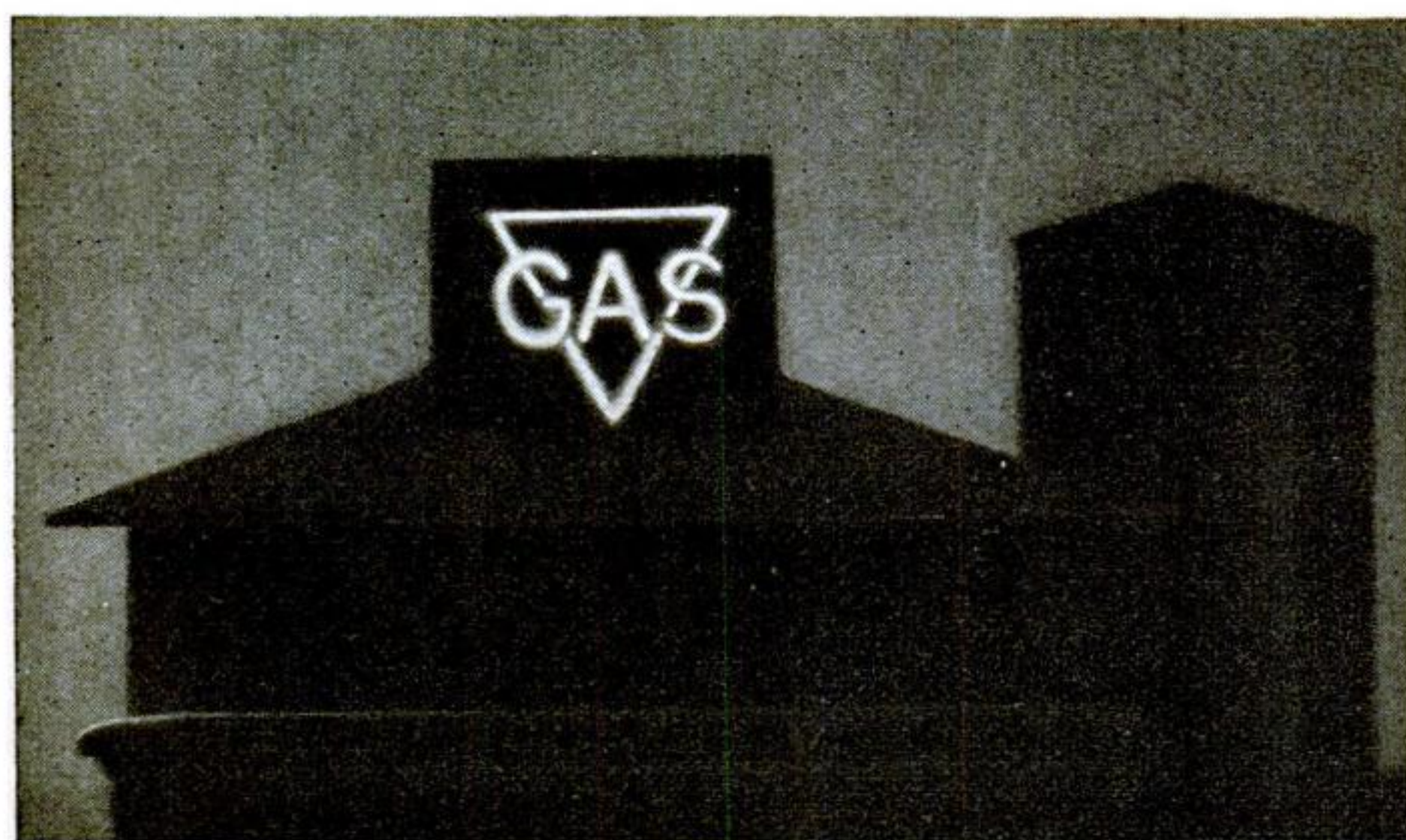


Factory and business buildings along the right-of-way require signs to make them look really natural

Behind the sign, two or three small bulbs flash on and off and light up the pinholes

sign with cardboard so that no light will be seen except through the pinholes. Tissue paper should be placed between the bulbs and the sign to produce an even diffusion of light. Install a flasher button of the type used for Christmas tree lights.

The neon sign is just as simply prepared and is perhaps even more decorative. Colored celluloid, the full size of the sign, is painted with flat wall paint of any desired color. Before the paint is completely dry, the letters are traced on the sign and the paint scraped away, permitting the light to shine through the colored celluloid. Like the other sign, it is backed with a bright tin reflector containing small light bulbs.—J. W. CLEMENT.

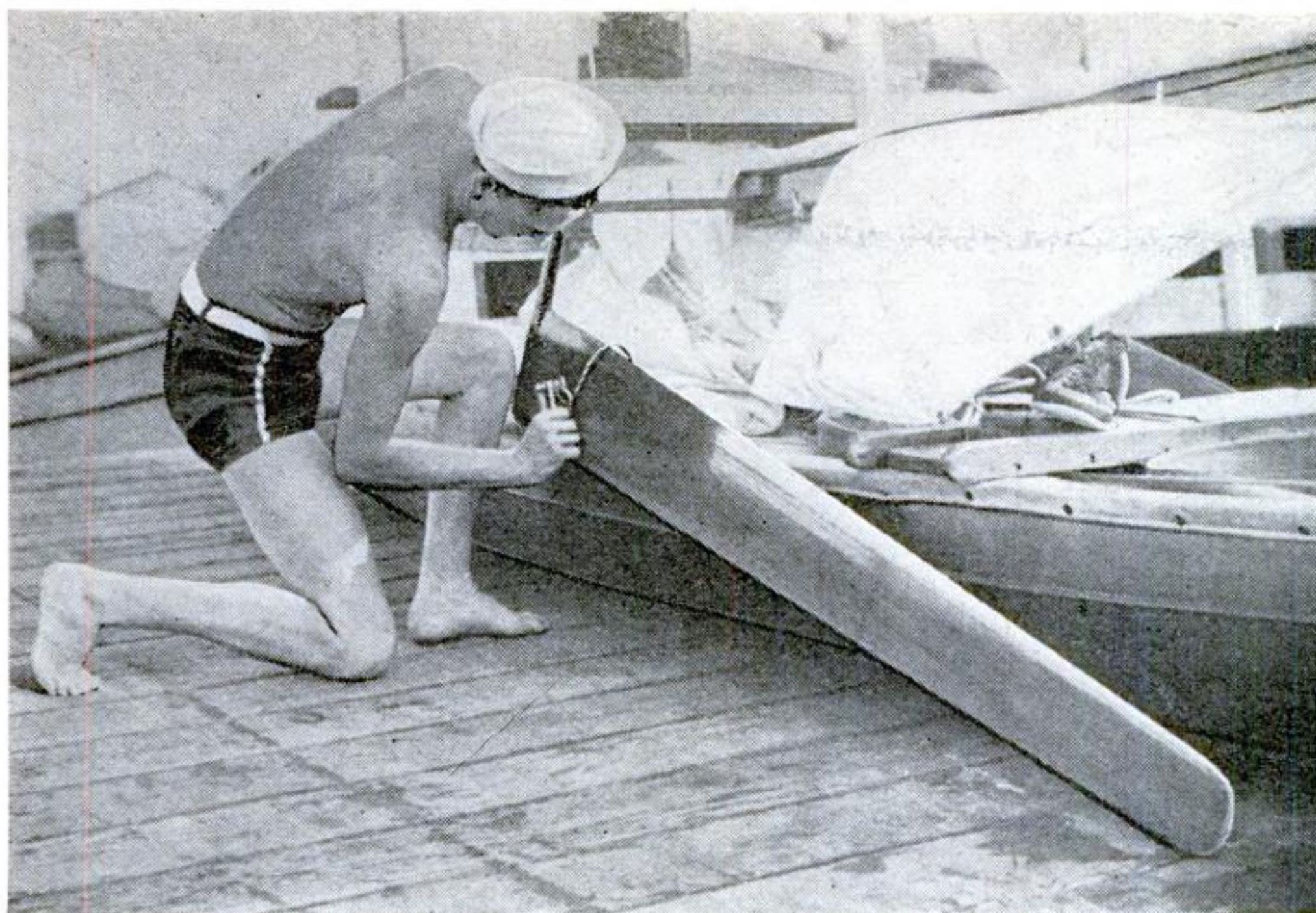


Light glowing through colored celluloid gives a neon-sign effect

Water Glass Imitates Ripples on Painted Lake

IF YOU have a model railroad layout or any other type of miniature scene that has a painted lake, waves can be imitated by brushing a solution of silicate of soda (water glass) on the painted surface. Being a water-soluble substance, the silicate of soda will tend to creep on the painted surface and roll up into

tiny waves. The thinner the solution, the smaller will be the ripples produced. In about two weeks' time you will notice a white crystallization around the edge of each ripple. Use a stiff brush to remove the excess crystallization, leaving a faint frosty edge similar to that produced by real waves.—C. V.

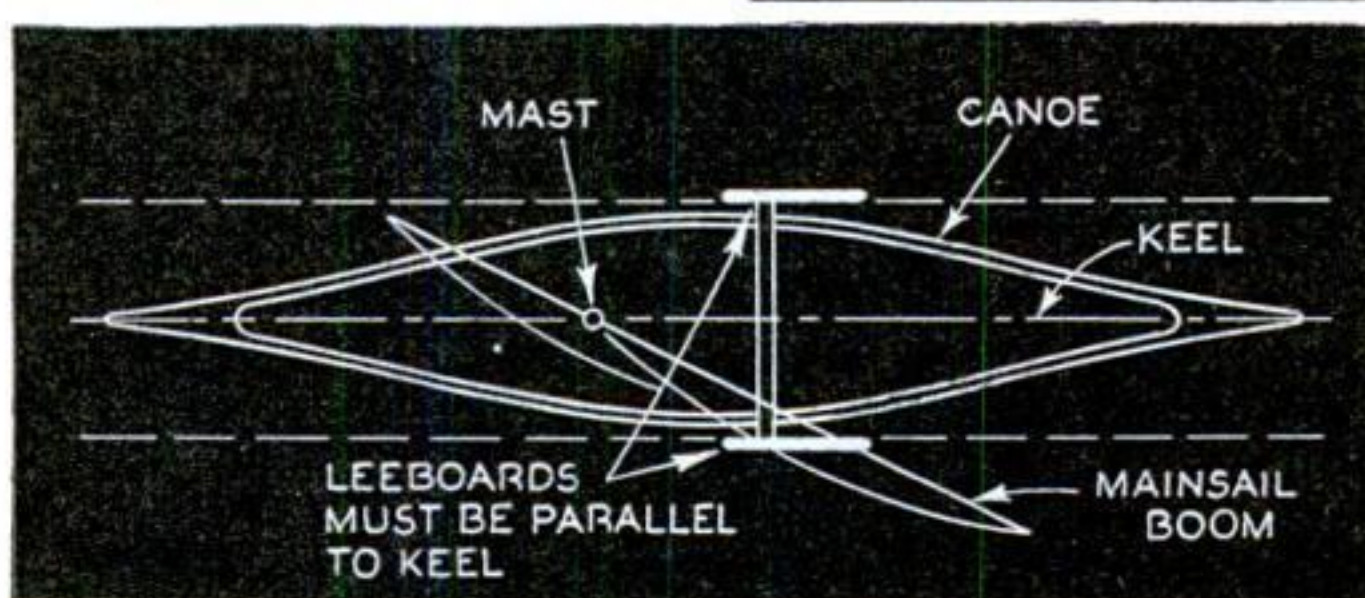
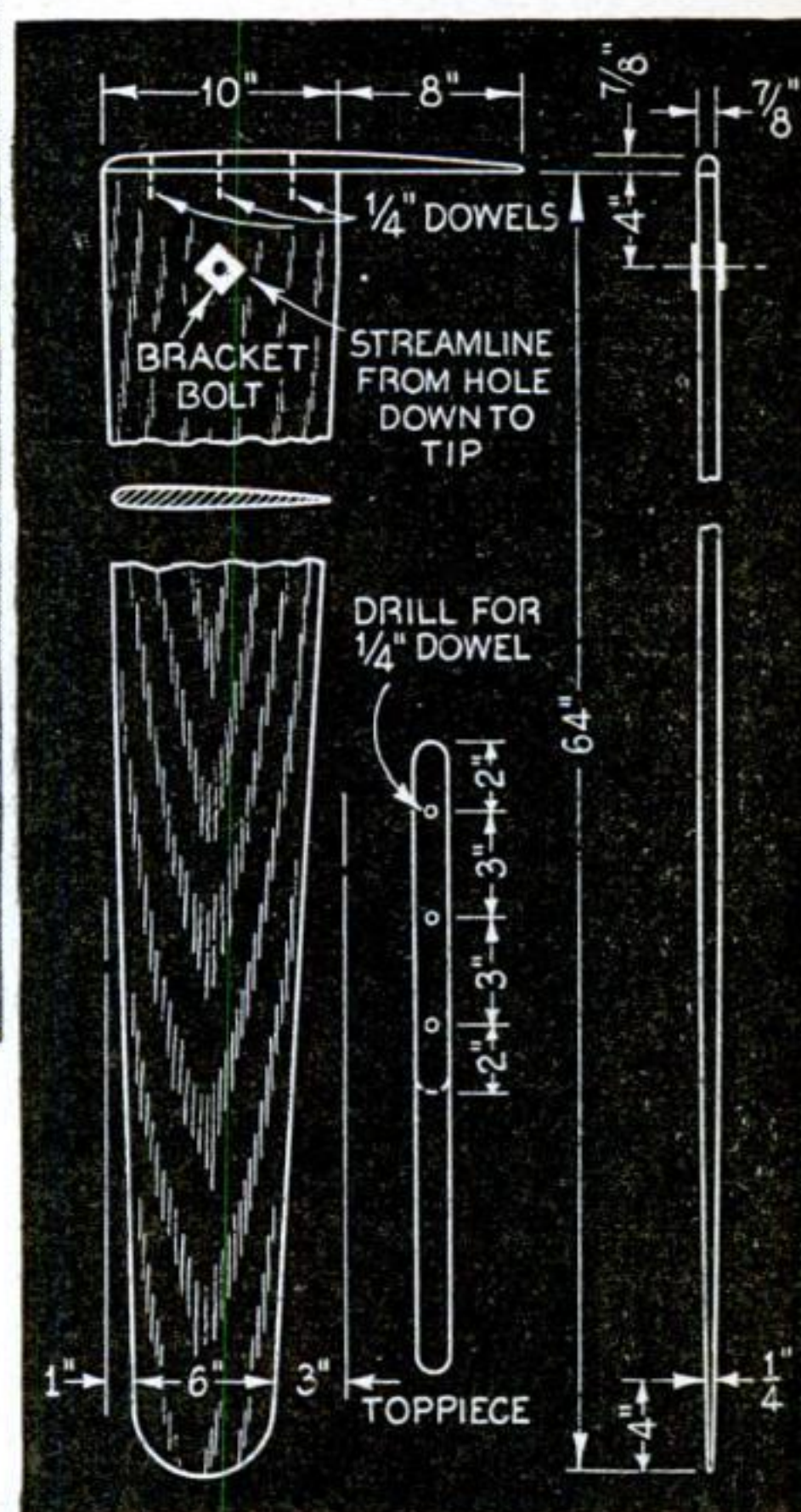


Streamline Leeboards HELP WIN CANOE CHAMPIONSHIP

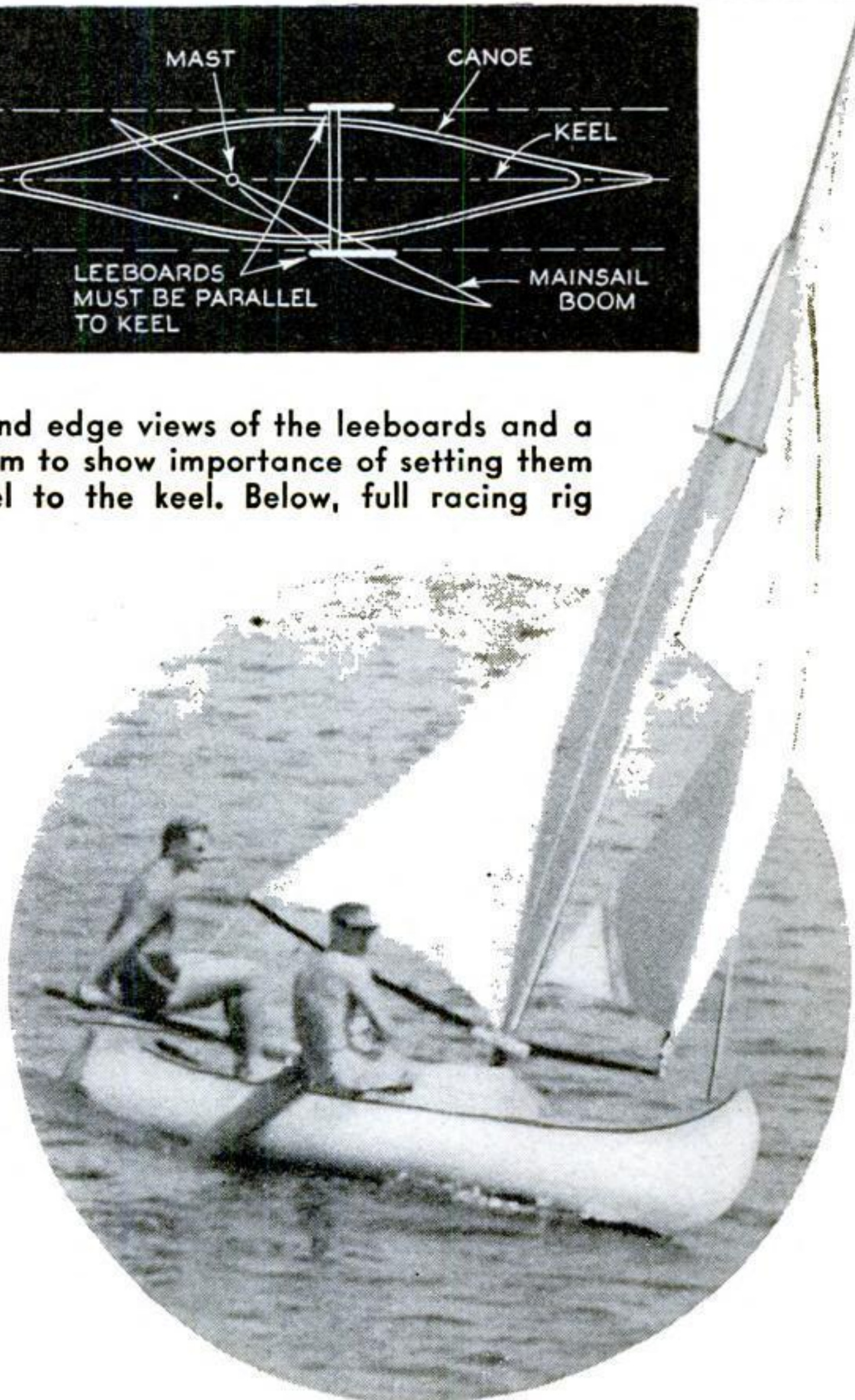
SPECIAL leeboards combined with the so-called "floating" rig described in a previous issue (P.S.M., Sept. '38, p. 58) enabled Herb Perlmutter, of City Island, N. Y., to win the Atlantic Coast class "B" Sailcanoe Championship last year. He took seven of the eight races in which he finished and came in second in the other. The leeboards, being long and narrow, add considerable speed, besides allowing the canoe to point better into the wind and come about easier.

Two pieces of straight-grained mahogany $\frac{7}{8}$ " by 10" by 5' 4" and two pieces of oak $\frac{7}{8}$ " by $\frac{7}{8}$ " by 18" are needed. The mahogany is tapered and rounded, both in thickness and width, to the dimensions shown. The edges are rounded from the top down to a streamline starting where the bracket hole is drilled, and the streamlining is continued down to the tip. The oak piece is doweled with waterproof glue to each leeboard, and rounded to form handles for lifting the leeboards. The whole assembly, particularly below the waterline, must be varnished as smoothly as possible. A hole is drilled in each board for the bracket bolt, and a washer is screwed to each side of the hole in both boards.

For the utmost efficiency from these or any leeboards, attach them to the canoe ashore. Make sure that the brackets are not twisted and that each leeboard is exactly parallel to the keel.—WALTER GOTTLIEB.



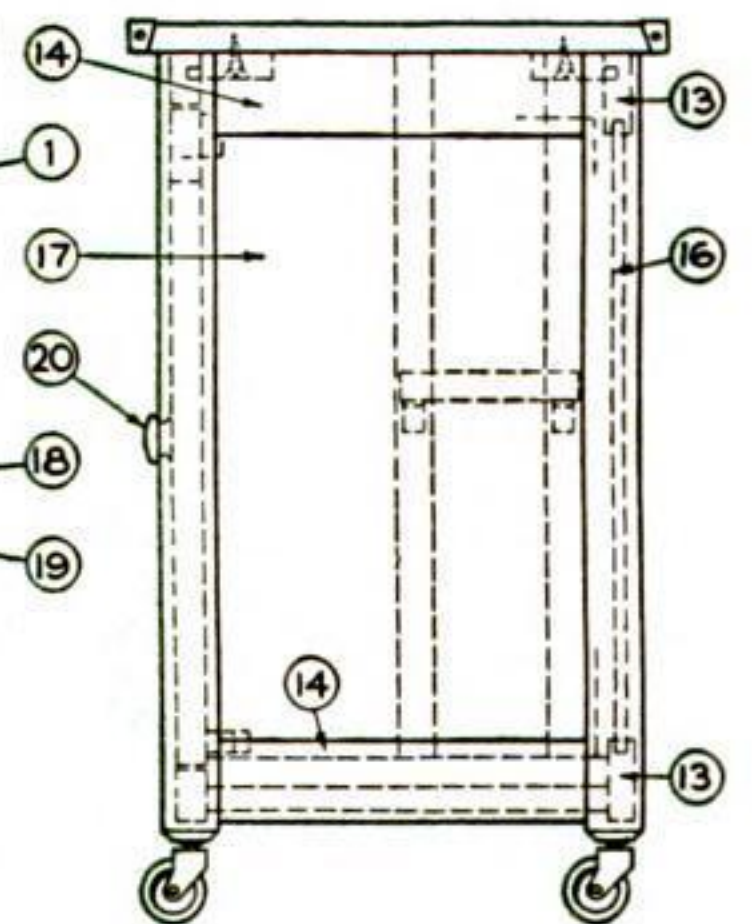
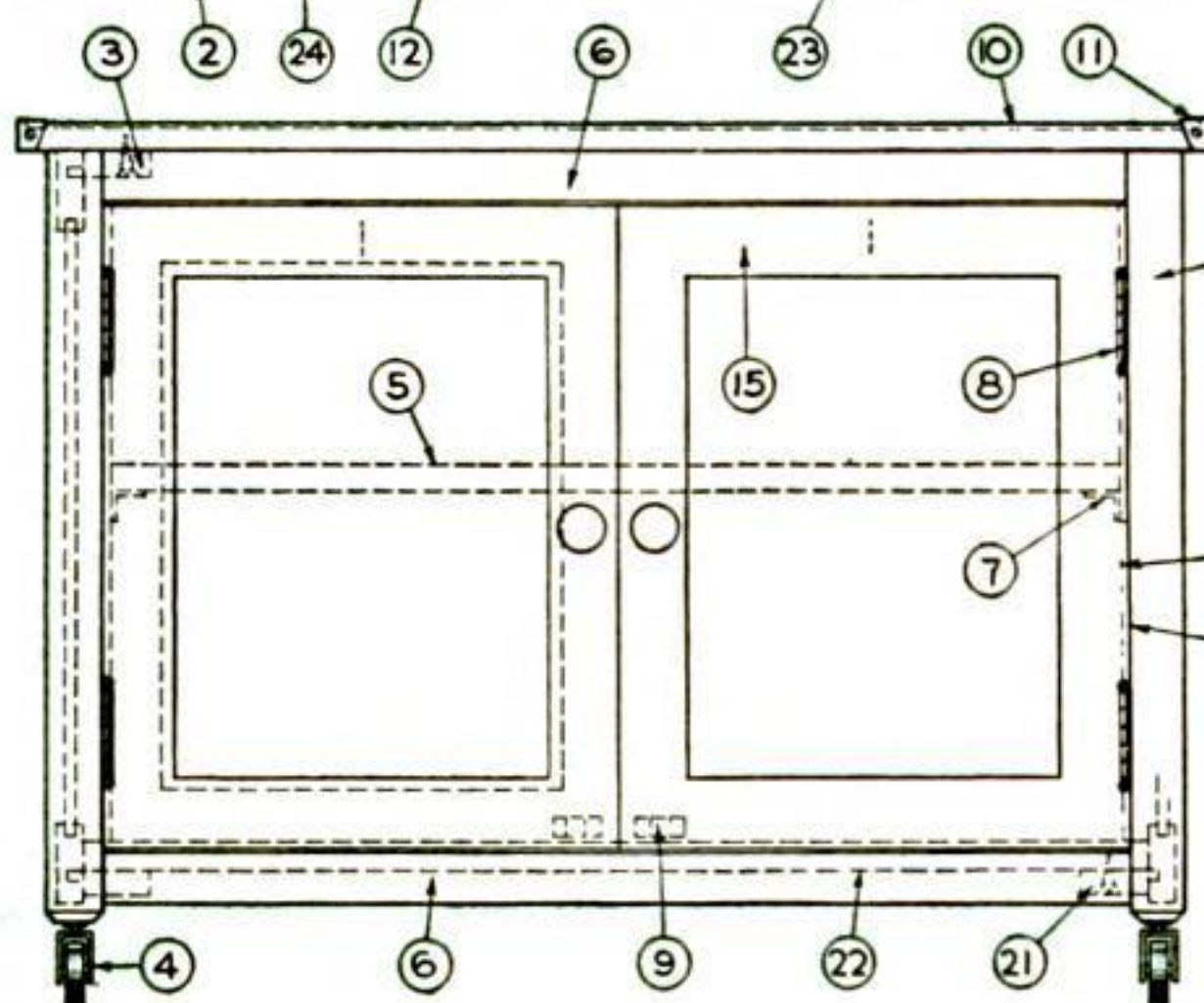
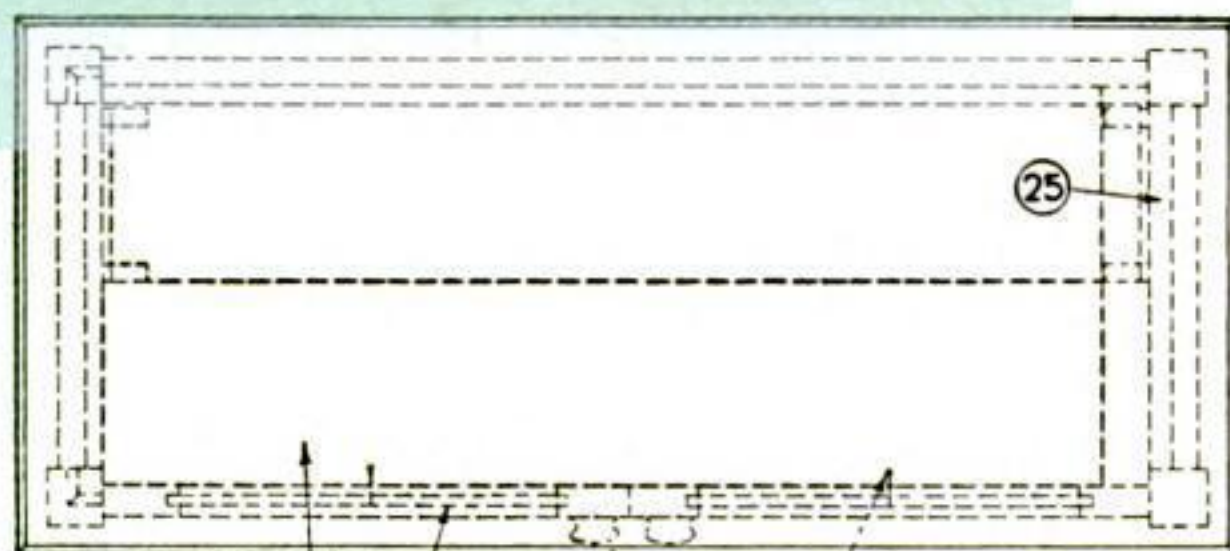
Side and edge views of the leeboards and a diagram to show importance of setting them parallel to the keel. Below, full racing rig



SMALL Rolling Cabinet SAVES STEPS IN KITCHEN



When the cabinet is not required for other purposes, it fits in the space generally found under the kitchen sink



The cabinet can be rolled out to serve as a seat and it is equally convenient for stacking dishes after meals



By
E. C.
HANLEY

IN A KITCHEN that is short of cupboard room, this little cabinet will be found useful. It may be rolled around where needed and finally pushed out of the way in that waste space generally found under the kitchen sink. Besides being a cupboard, it serves as a seat and as a place for stacking dishes at meal times.

General cabinet construction is followed. The drawing calls for a top $\frac{5}{8}$ " thick, but with the linoleum glued on, it will be $\frac{3}{4}$ " thick and will then fit snugly in the metal edging, which may be purchased. Special metal strips with adjustable brackets for the shelf may be obtained in most hardware stores; otherwise one may fasten a permanent cleat across the end of

the cabinet, in which case a good height for the shelf is about 10½" above the bottom of the cabinet.

If the top is to be fastened with the ten cleats indicated in the drawings, cut slots in the top rails before the assembly of parts is under way. One may obtain metal cleats at the hardware store to fasten the top if desired. Recesses can be cut out of the door stiles for the full thickness of the hinge.

If the cabinet is to be painted, lacquered, or enameled, there will be no harm in pinning the tenons of the rails in the legs with finishing nails after the glue has set. Such nail holes will have to be puttied after the priming coat. Likewise, a nail here and there through the bottom rails into the bottom of the cabinet will add extra support and strength.

After the linoleum is glued to the top, it should be clamped between boards overnight to insure a flat top. A set of trip catches will be necessary at the bottom of each door, and a set of hooks should be set in the doors for hanging the dish pan and drying rack. Details may be varied to suit individual requirements.

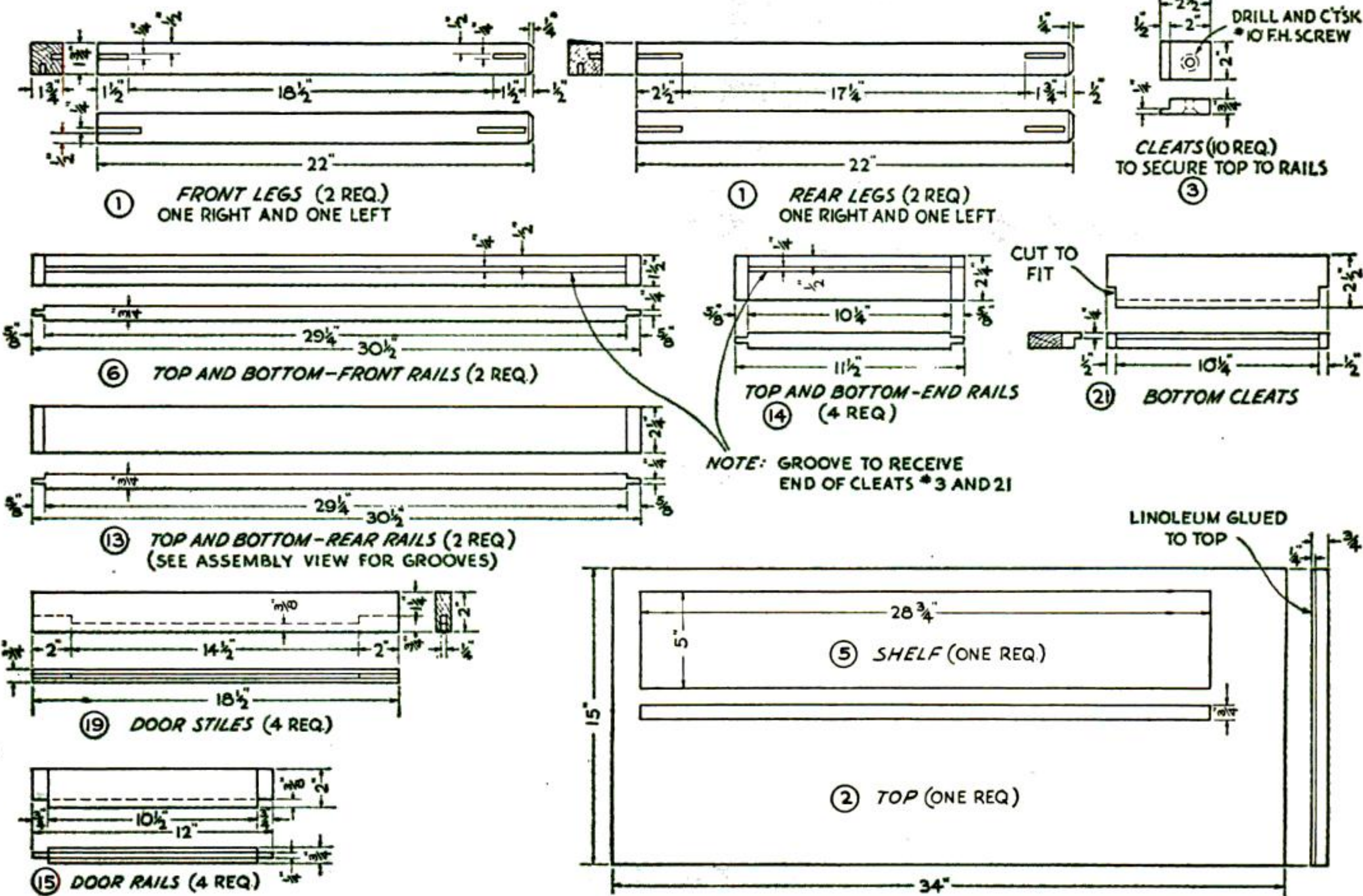
LIST OF MATERIALS

Part No.	Description	No. Pc.	T.	W.	L.
1	Legs	4	1¾	1¾	22½
6	Front rails	2	¾	1½	31
13	Rear rails	2	¾	2¼	31
14	End rails	4	¾	2¼	12
21	Bottom cleats	2	¾	2½	11½
3	Top cleats	10	¾	2	2½
24	Top	1	5/8	15	34
22	Bottom	1	¾	11½	30½
5	Shelf	1	¾	5	29
19	Door stiles	4	¾	2	19
15	Door rails	4	¾	2	12½
16	Back panel (3-ply)	1	¼	18	30
17	End panels (3-ply)	2	¼	11	18
12	Door panels (3-ply)	2	¼	11½	15½
25	Filler for inside end panels	2	¼	10	17

NOTE: Any good, sound wood may be used.

MISCELLANEOUS

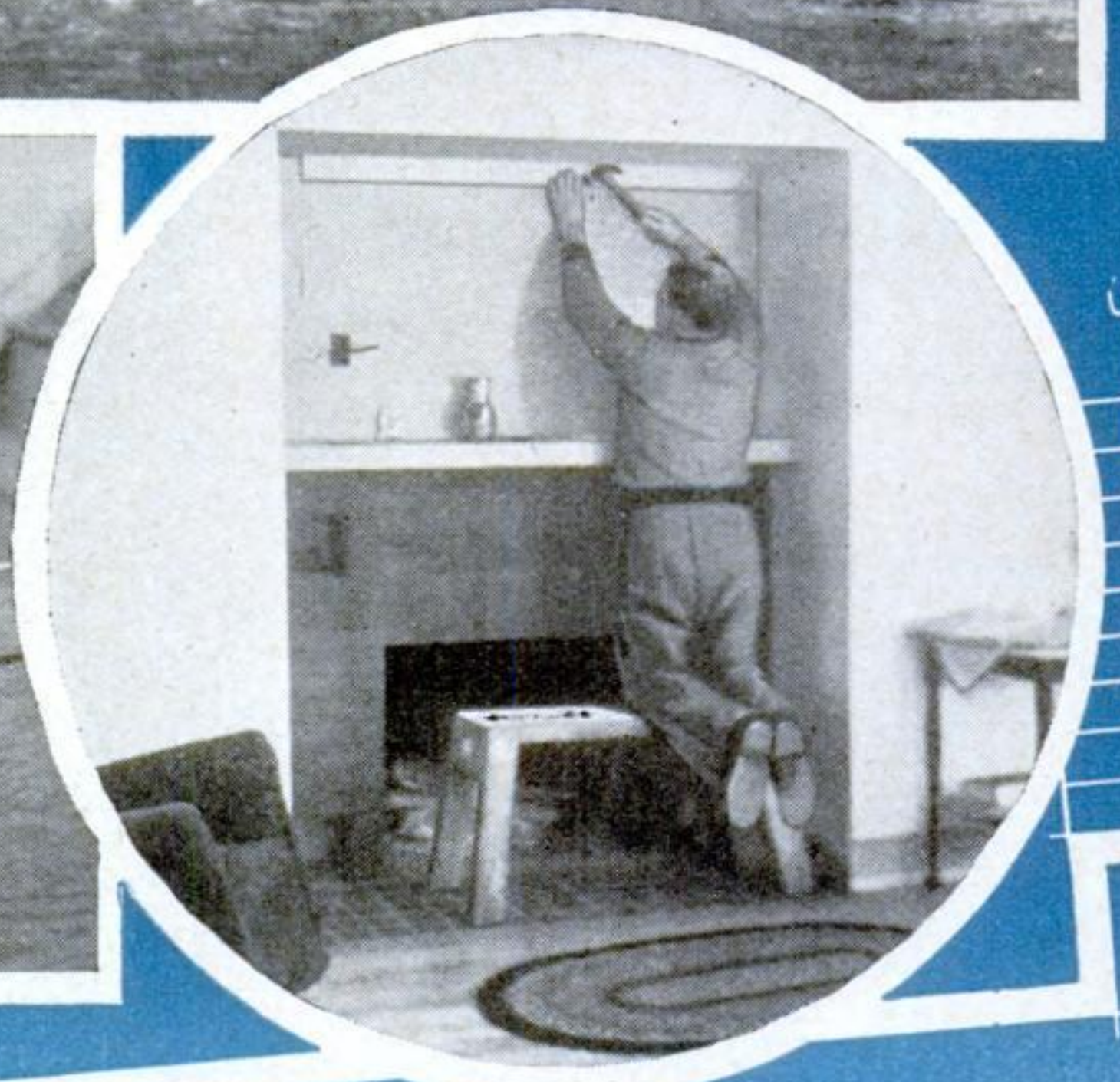
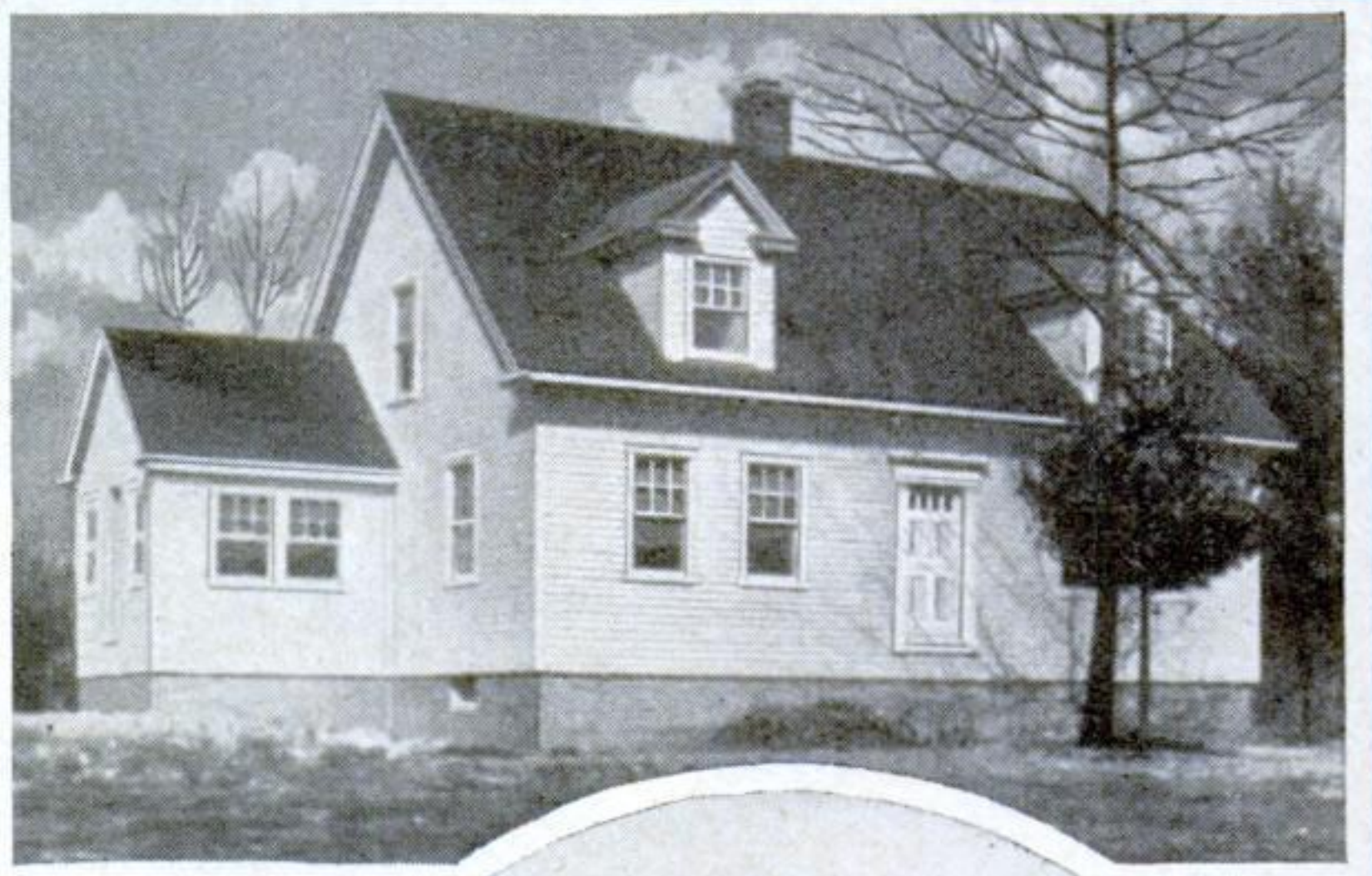
Part No.	No. Req.	Description
20	2	Door knobs
8	2 pr.	Butt hinges, 2½" by 1¾"
2	50"	Steel edging for top
11	4	Steel corner pieces for top corners
4	4	Grip-neck casters with 2" wheels
10	1	Linoleum, 34" by 15"
7-18	4	Vertical metal strips and brackets to support shelf
9	2	Sets of trip catches for doors
23	3	Brass hooks for doors



Details of the principal parts, each numbered to agree with the assembly drawings and list of materials

Truck Driver Builds House

The home of 25-year-old Julian Knapp as it nears completion. Although he had had no previous experience, he did nearly all the work without aid



FLOOR PLAN

ON ONE of the main highways leading into Ware, Mass., stand a two-story dwelling and two chicken houses. Built by one man in his spare time, they might be called monuments to ambition. Julian Knapp was earning only \$15 a week as a truck driver when he decided that he wanted to own a farm. His friends advised against it. "You won't like farming," they said. "You'll be in debt for life, and it will be a waste of money." But he refused to be dissuaded.

Although he supports his mother and takes care of all household expenses, he managed, by careful saving, to accumulate \$1,000. He had never attempted carpentry before; nevertheless, he decided to build two large hen houses on a three-acre plot he had acquired. It was hard work, made doubly hard because every day he had first to drive a 2½-ton truck around the city for eight hours before he could take up his hammer and saw.

With the chicken houses completed, Knapp began to plan his home. Innumerable visits

in Spare Time



Guildcrafter's Feat Is High Spot in News from Home Workshop Clubs

were made to the public library; books were borrowed from friends and from the Ware Homeworkshop Club, of which he is a member. An architect drew up the plans and showed him how to read blueprints. He dug the foundation, made his own forms, and erected the house with hardly any help. A hurricane and flood last year carried away part of his lumber and tools and wrecked his chicken houses, but even this blow did not discourage him.

Fourteen weeks after he started the foun-

dation, he moved in. The outside porches are missing, and, indeed, some plastering and plumbing still remain to be done on the inside, but even this work will soon be completed. Knapp estimates that approximately eighty-five per cent was done without any outside help.

Several weeks ago Knapp told his experiences before the Ware Homeworkshop Club and thanked the members for their assistance. He admitted that the difficulties encountered often appalled him temporarily, but he always managed to surmount them. "Now I feel I have done a fair job, at least for a first effort," he said. "The house is not perfect—it has its faults. But if we didn't make mistakes, we would have nothing to learn."

Members of other clubs affiliated with the National Homeworkshop Guild have also succeeded in noteworthy projects. The *Brunswick (Me.)* Homeworkshop Club recently made sixteen pieces of scenery for the Brunswick High School. Programs this spring have included demonstrations of hard and soft soldering, electric wiring, and planing.

The *Ashland (Ohio)* Homeworkshop Club has voted to have an exhibit at the hobby fair sponsored by the local Rotary Club. R. M. Boffenmyer demonstrated cane weaving recently . . . Metal spinning and wood turning were demonstrated by Paul Alford when the Sohio Homeworkshop Club of *Cleveland, Ohio*, met in the workshop of W. P. Gibbons . . . To illustrate the use of circular

saw, shaper, and sander, F. C. DeBoe made a frame for the charter of the *Vicksburg (Miss.)* Homeworkshop Club . . . The Bison Builders Guild of *Buffalo, N. Y.*, hopes to have its model railroad layout completed within a month . . . Demonstrations of developing and printing photographs, and on gluing and the uses of precision tools and hand grinders have been given before the *Saginaw (Mich.)* Homecraft Club.

Meetings of the Ohio Valley Homecraft Guild are held in the various manual training



Entries of the Columbus (Ohio) Homecraft Club in the wood- and metal-working section of the Central Ohio Hobby Show. Despite the large number of contestants, the club members were able to win seventeen prizes

shops of schools in *Wheeling, W. Va.*, and vicinity so that large groups can be accommodated and so that new members from various nearby communities will be attracted. The school instructors are always in attendance.

Charles Morgan, of the Juniata Homeworkshop Club, *Philadelphia, Pa.*, won a prize for his penknife carving at the Philadelphia Hobby Show. At present, most of the members are working on models.

R. V. Mead was in charge of the exhibit held by the *Newton (Mass.)* Homecrafters Club. A. A. Dulac demonstrated wood finishing at a recent meeting . . . The *Preston (Ont., Canada)* Homecraft Club gave away a library table to raise money . . . "Power Within," a moving picture, was enjoyed by the *Wilmerding (Pa.)* Homeworkshop Guild . . . The *Nutley (N. J.)* Homeworkshop Guild celebrated its first anniversary with a party at the home of Robert Ide . . . As a gesture of friendliness, the South Shore Homeworkshop Club, *Quincy, Mass.*, sent a telegram to the New Bedford Woodcraft Club wishing the members success with their exhibit . . . Cecil Black gave a talk on commercial photography at the anniversary meeting of the Riverside Homecrafters Guild, *Jeffersonville, Ind.*, held at the home of Walter C. Vertreace, secretary . . . The *Denver (Colo.)* Homeworkshop Club has distributed toy patterns to its members so that work can begin at once on the Christmas project.

With the money raised from its annual auction of articles made by members, the

Jacksonville (Fla.) Homeworkshop Club has purchased three orthopedic wheel chairs for crippled children at a local hospital and donated nearly \$50 to the Optimist Club for work among underprivileged boys.

Carving plastics was demonstrated to the *Ware (Mass.)* Craftsman Guild by Garven F. Williams, who brought two cases of his work to the meeting for display. Several reels of movies were shown by Stuart D. Pike, an engineer at the Quabbin Reservoir. John J. Vertic has made a large banner for the club.

The Bushwick Homeworkshop Club, *Brooklyn, N. Y.*, has rented a room 10' by 50' which will be equipped as a model workshop. Projects constructed by members will be on display at all times.

How to Organize a Club

DO ANY of your neighbors and other nearby residents own home workshops? If so, band them together into a club and you will then be eligible to receive the many free benefits that the National Homeworkshop Guild, 347 Fourth Avenue, New York, distributes to hundreds of such groups. For complete information, send a large (legal size), stamped, and self-addressed envelope.

The Fireside Homeworkshop Club, *New York City*, plans to purchase a woodworking lathe for the club workshop . . . Frank P. Tompkins demonstrated the engraving of name plates before the *Peekskill (N. Y.)* Homeworkshop Club . . . The *Rodeo (Calif.)* Homeworkshop Club recently visited the shop of a cabinetmaker who showed the members how to make cabinet doors and how to use power machinery . . . Programs of the *Freeport (N. Y.)* Craftsman's Guild have included demonstrations of tool sharpening and use of the steel square, two exhibits, and the making of toys for poor children . . . Lathe demonstrations were given by members of the *Apollo (Pa.)* Homecraft Club when it met at the home of Laird Boarts . . . Two exhibitions have been sponsored by the Petrolia Woodworkers Club, *Wellsville, N. Y.*

A moving picture, "The development of the Lathe," was shown to the *Mt. Gilead (Ohio)* Homeworkshop Club . . . The *Whitehall (N. Y.)* Homeworkshop Club is estab-



Carl Stargardt, toolmaker and vice president of the club in Muskegon, Mich., demonstrates uses of the engine lathe

lishing a club workshop . . . Members of the *St. Joseph (Mich.)* Homeworkshop Club spent an interesting evening learning the uses of a motorized hand tool . . . In appreciation of the work Professor A. C. Easton has done as instructor for the *Lincoln (Nebr.)* Home-

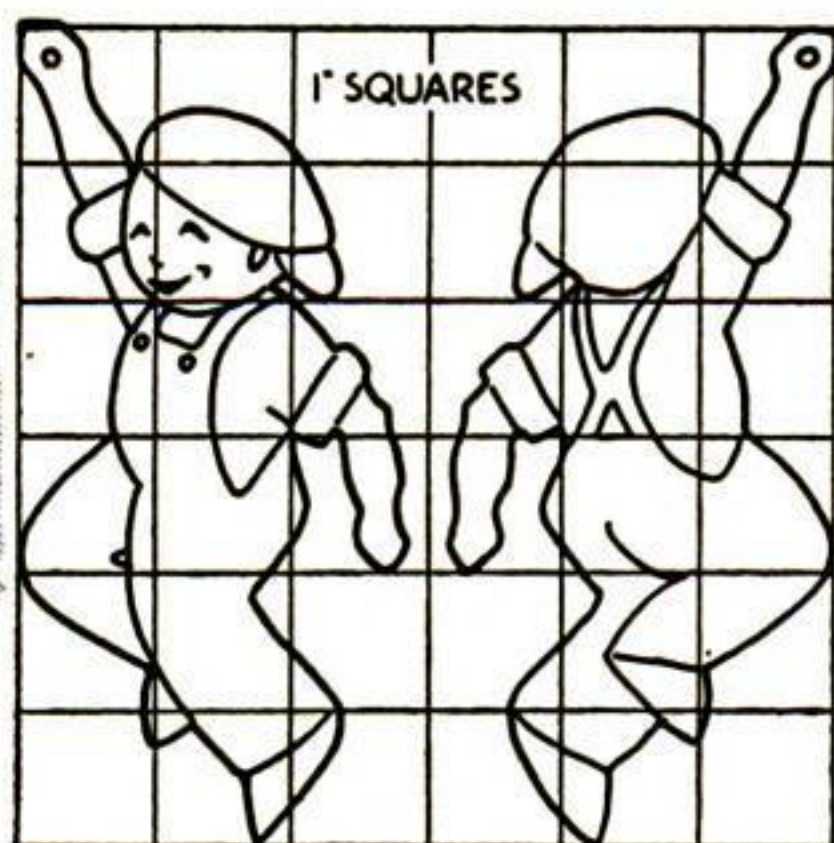
workshop Club, the members presented him with a set of tools. The meeting was held at the home of Mr. and Mrs. J. J. Buck, and a vase was given to Mrs. Buck . . . L. Hull showed color pictures at a meeting of the Mazda Homeworkshop Club, *Euclid, Ohio* . . . The Liberty Rock Craftsmen, *Devon, Conn.*, have begun work on a toy project.

The enthusiastic coöperation of the *Columbus (Ohio)* Homecraft Club with the Columbus Junior Chamber of Commerce was largely responsible for the success of the Central Ohio Hobby Show. Secretary Carl L. Phalor reports: "Dan Fulmer, a past president and very active member, was head ringmaster of the show and opened it with a radio address. Our president, Dr. William Palchanis, was chairman of the woodworking and metal-working exhibits and gave a fifteen-minute radio talk from the floor of the show, describing the prize-winning entries."



Brunswick (Me.) Homeworkshop Club making scenery for the local high school. Three meetings were devoted to constructing sixteen pieces

Comical Figure in Overalls Serves as a Shade Pull

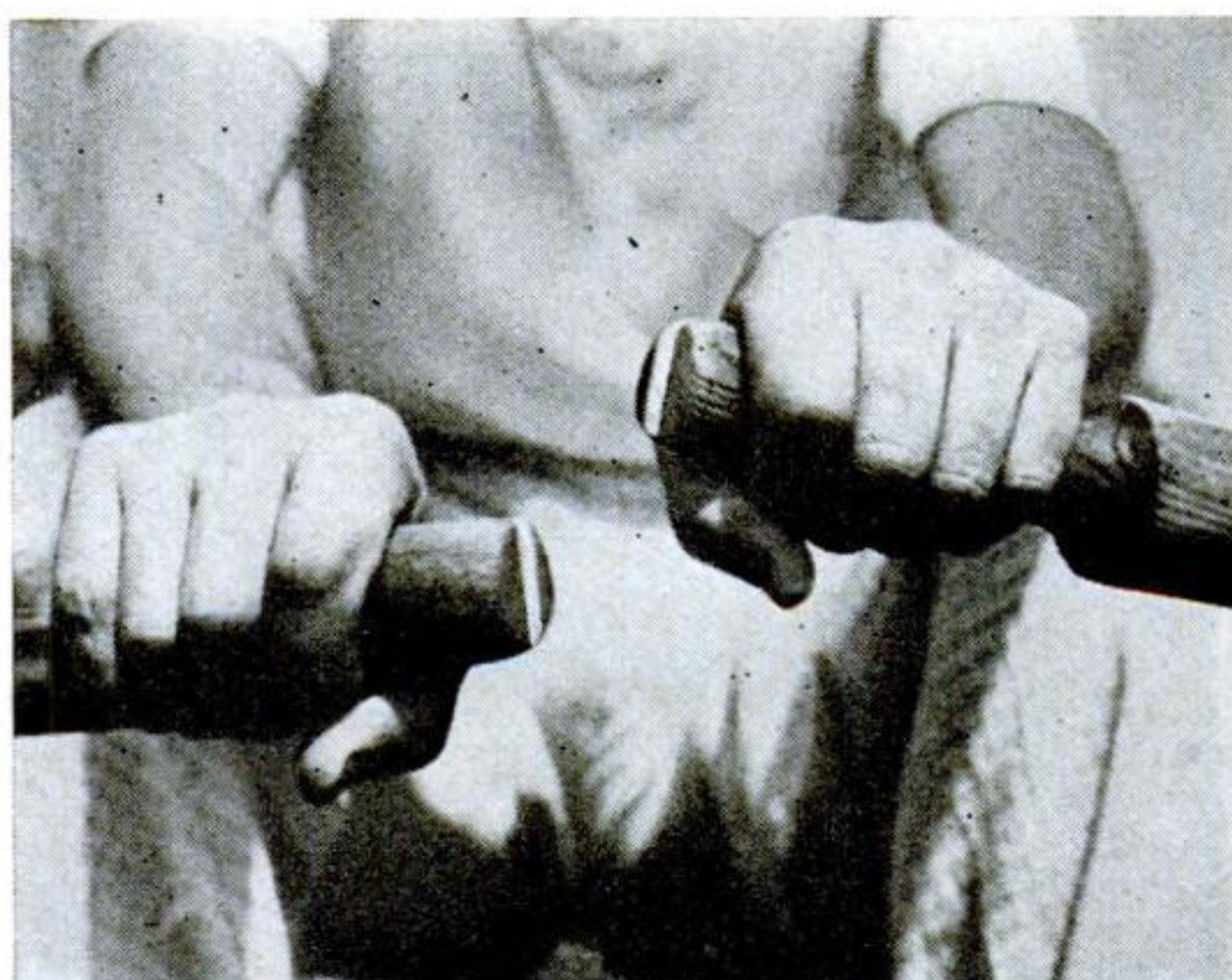


Front and back views of the shade-pull, which is jig-sawed from a scrap of $\frac{1}{4}$ " plywood

A CHEERFUL, amusing touch may be added to a child's bedroom or a play-room by making the shade pulls in the form of an overalls-clad figure, as illustrated. First prepare a full-size pattern on paper by drawing 1" squares and copying the figure. Transfer this to a piece of $\frac{1}{4}$ " plywood and cut it out. Drill a hole for the cord. Sandpaper the edges and round the corners slightly, then paint the figure to suit your fancy or to match the decorations in the room.—H. F. S.

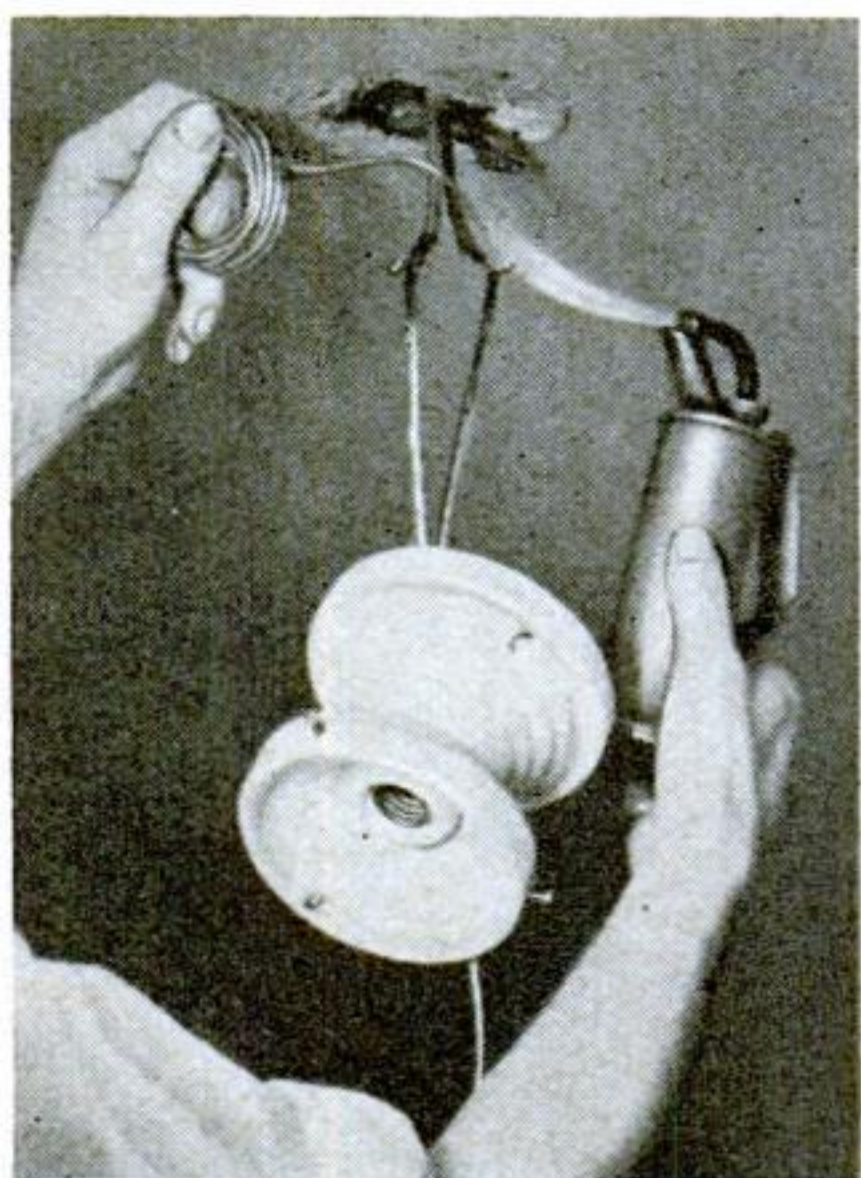
Grooves in Ends of Oars Aid in Night Rowing

ROWING in the dark is often slowed up considerably because of the impossibility of seeing whether or not the oar blades are at right angles to the surface of the water at the beginning of each stroke. The oars have an annoying tendency to turn in the grasp, especially if the rower has to twist around on the seat from time to time to see some distant light he is using as a beacon. To overcome this difficulty, cut a groove across the end grain of the grip on each oar parallel with the blades. In the dark the grooves can be felt with the thumbs.—B. BROWNOLD.



ELECTRICAL CONNECTIONS

[ELECTRICAL]

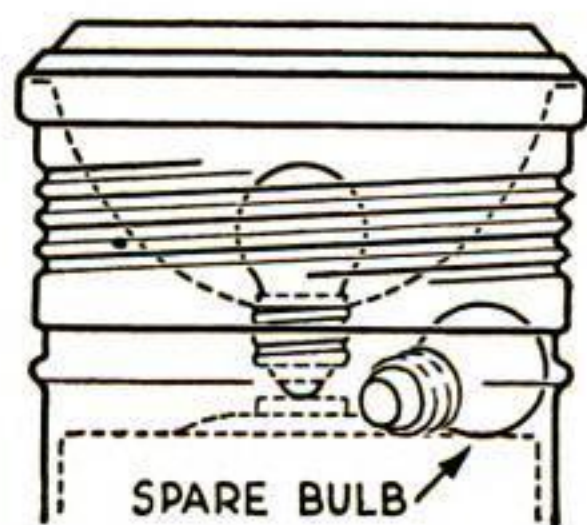


No electrical joints or connections can be properly made without either soldering them or using approved solderless connectors. Splices that are merely twisted together and taped will result in a high-resistance joint in time, causing a loss in the flow of electricity. Use soldering paste rather than highly concentrated acid as a flux, and apply sufficient heat to cause the solder to run well into the joint. An alcohol torch is useful for this. All joints should then be wrapped with both *rubber* and *friction* tapes, applied tightly and covering the end of the joint adequately. A little tape, well applied, is better than a large ball of loosely wrapped tape.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

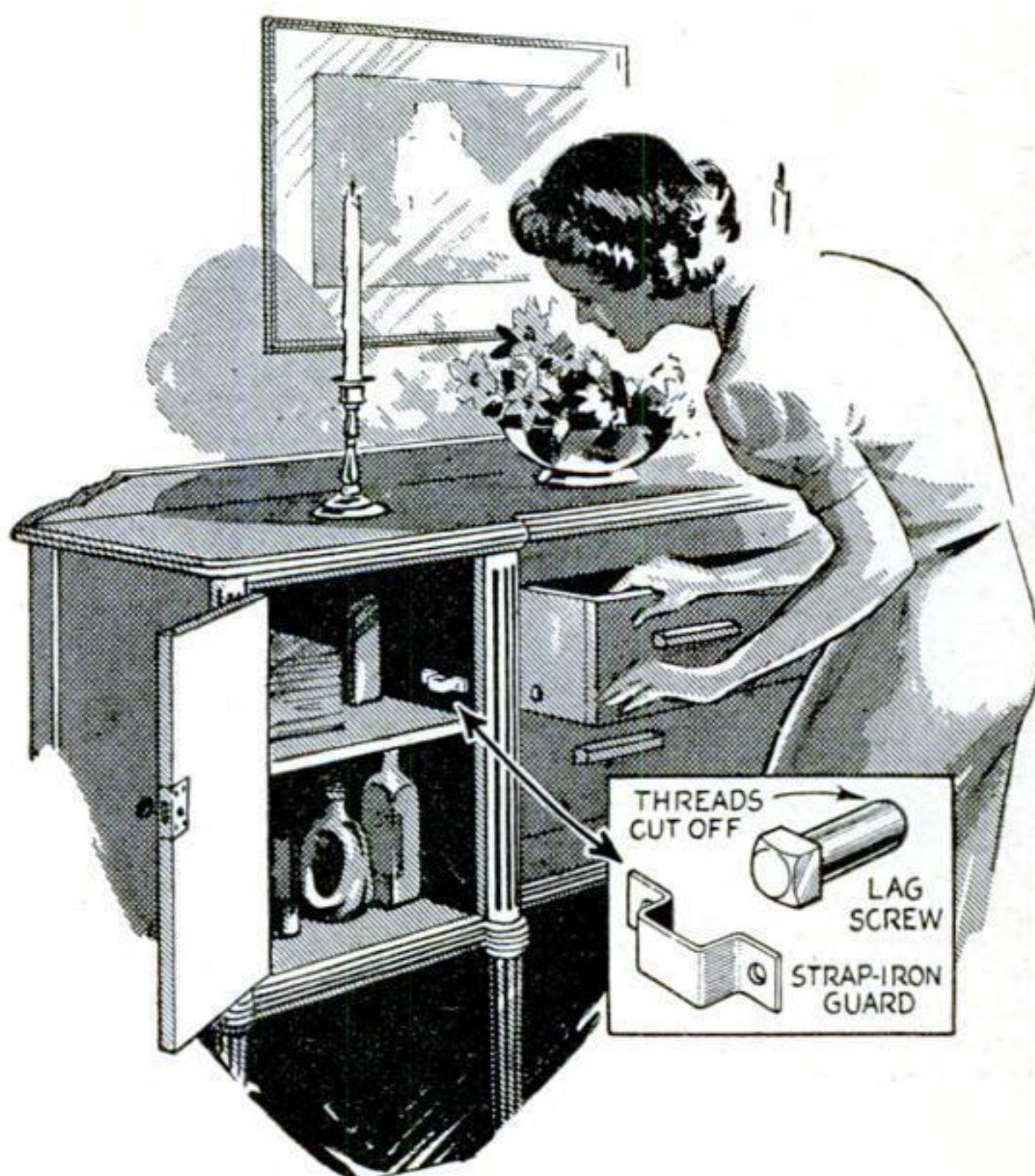
Carrying a Spare Bulb for Use in a Flash Light

WHEN a flash light has no spare space for an extra lamp, one can usually be carried in the curved space between reflector and battery. Most flash lights using regular-size cells have this space. The bulb should be wrapped in tissue paper to prevent rattling.—THOMAS E. MILLER.



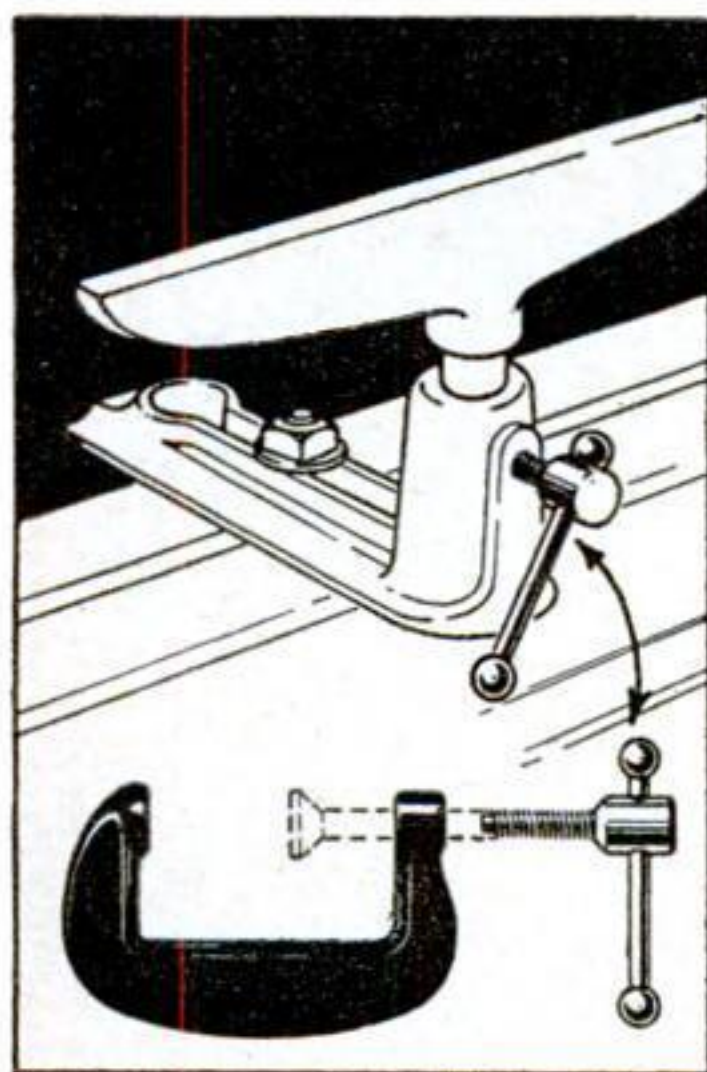
Buffet Drawers Locked by Concealed Bolts

HIDDEN drawer locks can be made as shown below for a buffet or any piece of furniture having drawers adjacent to a compartment with a door. A hole about $\frac{5}{8}$ " in diameter is drilled through the side of the compartment and continued through the side of the drawer. Through this hole is thrust a snugly fitting lag screw or bolt, cut short enough not to interfere with the contents of the drawer. Fit a guard to keep the bolt from coming out too far.—B.B.



C-Clamp Provides Screw for Lathe Tool Rest

TIME can be saved in setting the tool rest of a small wood-turning lathe if the usual bolt-type set screw is replaced with a screw taken from a ten-cent C-clamp. If a clamp is selected with a screw of the same diameter as the original set screw, it will usually be found that the threads fit. Cut the clamp screw the same length as the bolt set screw and file the end smooth. No wrench is then needed to make adjustments.—LECIL J. SLABACK.

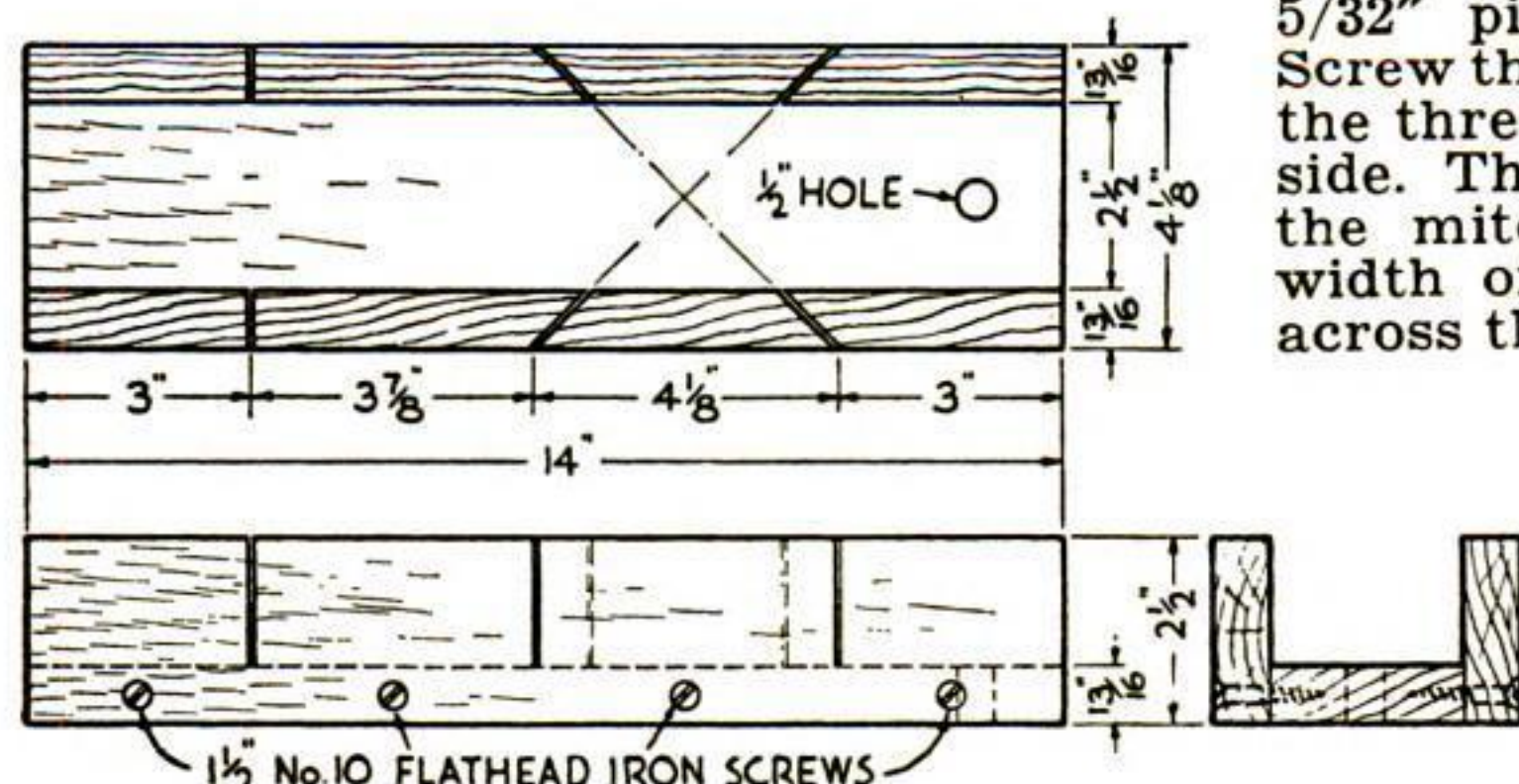


WOODEN MITER BOX

[WOODWORKING]

Dimensions are given for a small miter box, but larger ones may be made similarly.

1. Select a piece of straight-grained hardwood, such as maple or birch, wide

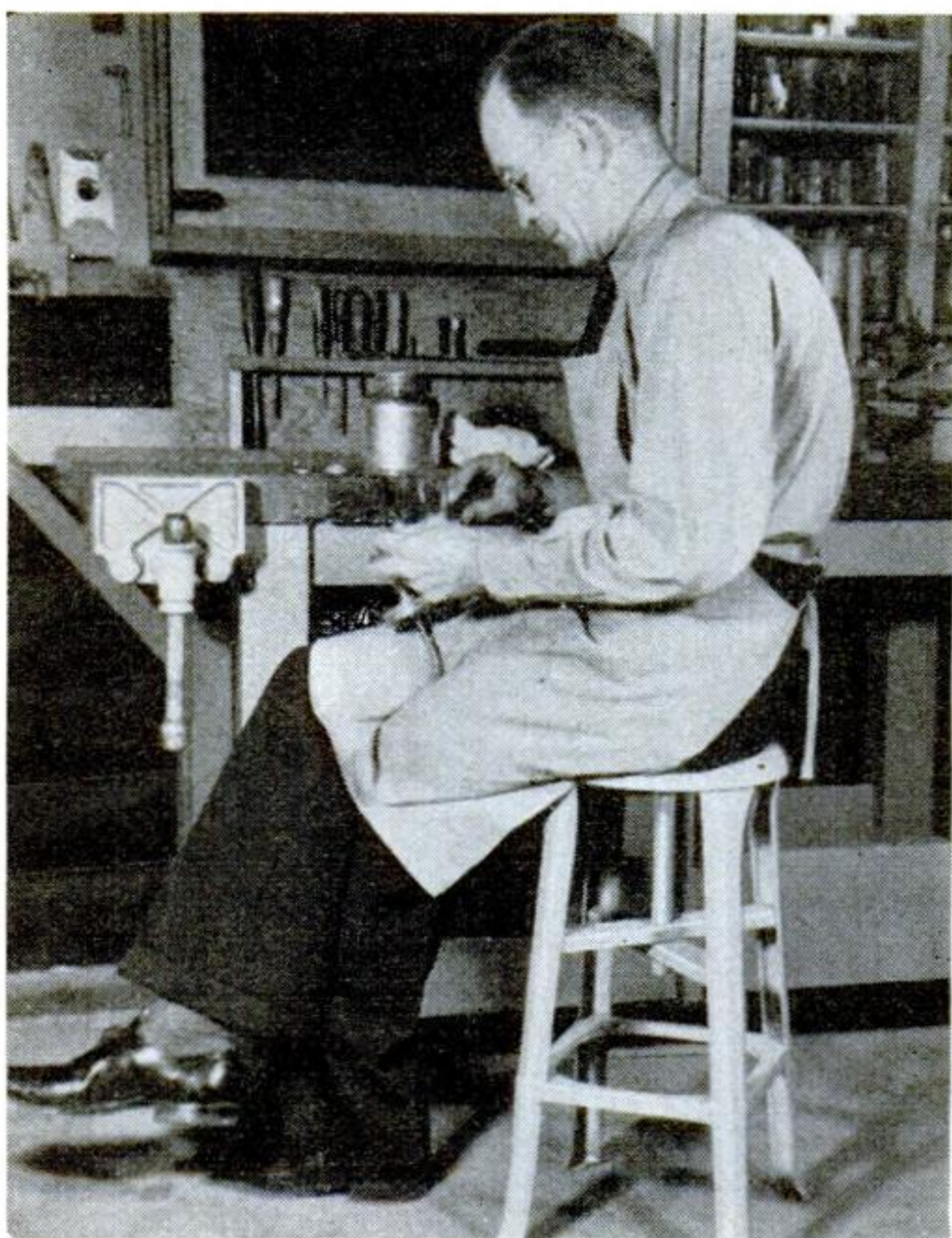


enough to cut all three pieces, if possible. Saw it to length, plane one edge, square both ends, and rip three strips. Plane the edges straight, square, and to uniform width. 2. Bore and counter-sink $\frac{7}{32}$ " holes for screws, and bore $\frac{5}{32}$ " pilot holes into the bottom. 3. Screw the parts together, using soap on the threads. 4. Lay out the cuts on one side. The distance between the ends of the miter cuts is equal to the total width of the box. Square these lines across the top and down the other side.

5. Draw the diagonals and make the saw cuts with a back saw. If an iron miter box is available, greater accuracy may be obtained by clamping the wooden box in the iron one while sawing.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Spray-Painting Turntable Added to Shop Stool



Stool with revolving top to facilitate painting small objects. The top may be removed when not required

A 24" high wood or metal stool may be converted into a convenient turntable for spray painting. When not required for that purpose, the top may be removed and the stool used for tedious jobs at the workbench or jig saw.

Bore a 1" hole in the center of the seat and bolt a 3½" by ¾" floor flange directly underneath. Into the floor flange, screw a piece

of ¾" pipe 11" long, capped on one end. The cap acts as a support or bearing for a length of ⅜" pipe, which is attached to the revolving top with a 3" by ⅜" floor flange. The top may be of ¾" plywood, from 24" to 30" in diameter. Cut the ⅜" pipe of sufficient length so that the turntable section is entirely supported by the cap on the ¾" pipe. Brace the ¾" pipe from the legs of the stool.

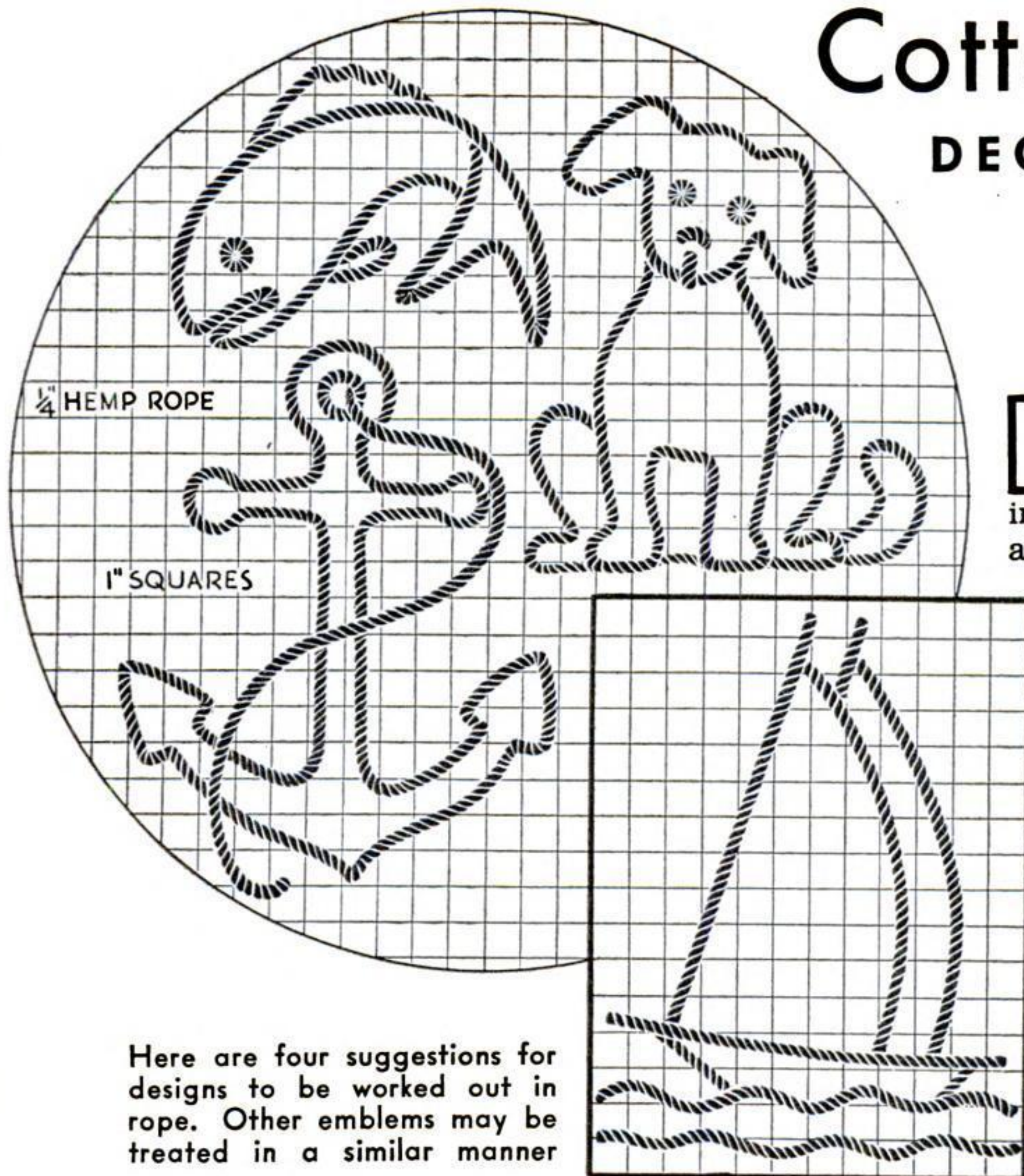


Old Hedge Shears Improved by Notching Lower Blade

BADLY worn hedge shears often can be given a new lease on life. Since the fault lies generally in the slight bend in the blades due to hard usage—a fault that is difficult to cure—the following procedure will do the trick: Clean the shears with light oil or gasoline, and then file a series of shallow notches about ¼" apart in the blade that is normally held underneath when cutting. Use a triangular file held across the blade at the old sharpening angle, with the point directed towards the handles at an angle of about 30 deg. These small notches hold the smallest twig until cut, and also aid in cutting the larger ones. The shears cut cleanly and easily.—GEORGE E. MAGEE.

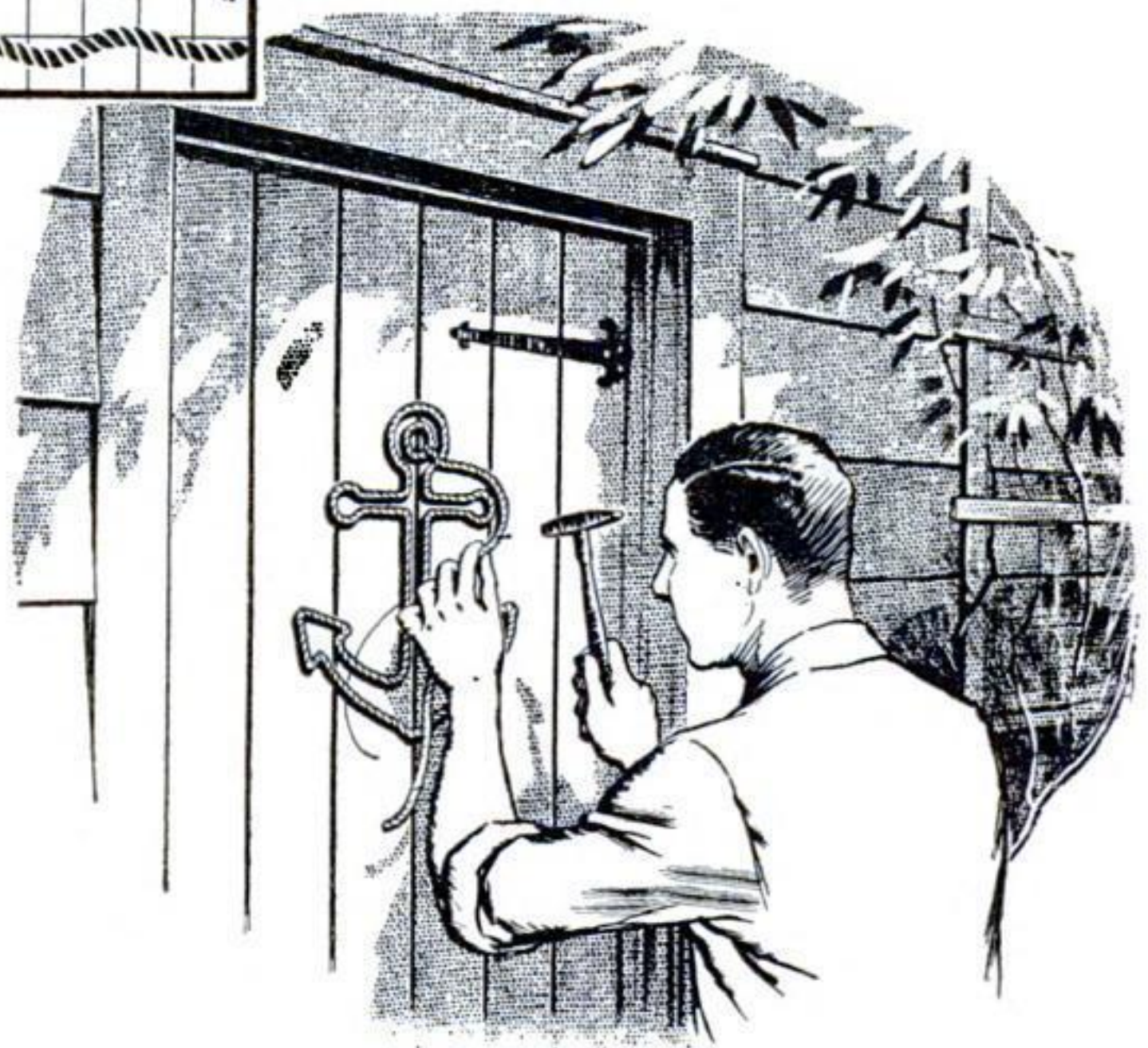
Cottage Doors

DECORATED WITH ROPE



Here are four suggestions for designs to be worked out in rope. Other emblems may be treated in a similar manner

DESIGNS outlined in rope form decorative emblems for doors of summer cottages and cabins. Several suggestions are given at the left. For comparatively large and simple patterns, $\frac{1}{4}$ " rope is nailed over a chalk outline with brass escutcheon pins. Smaller and more intricate designs are worked out in chalk line secured with common brass pins cut off to make brads. If the rope or cord is given two or three coats of shellac, it will become stiff and remain in the position to which it is bent. It is important, of course, to use brass pins because steel ones would rust in time and cause unsightly stains.



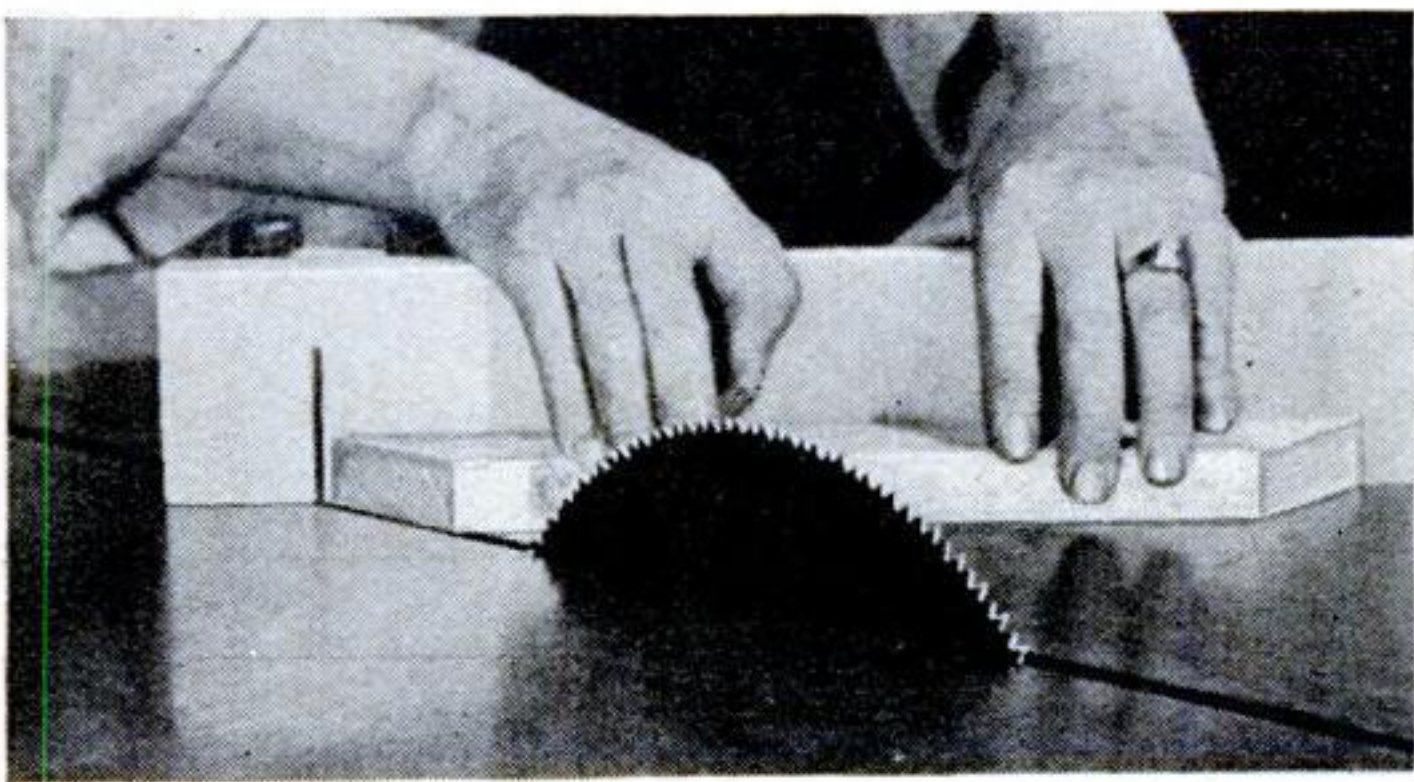
The rope is fastened on the door with brass escutcheon pins and then shellacked to stiffen it

Nailing Boards to Concrete

FLOORING nails of cut steel, which are often used for hardwood floors and can be obtained at large hardware stores, are excellent for nailing boards or cleats to concrete walls. Use a heavy hammer and strike a hard, square blow. The nail should be driven straight, not on a slant.—ARTHUR L. D. FORD.

Sandpaper on Saw Guide Is Aid in Mitering

IN CUTTING miters on the circular saw, there is always a strong tendency for the wood to pull along the saw guide because of the angle at which the stock is being cut. If a piece of sandpaper is glued or tacked to the saw guide, the wood will not slip and much less pressure of the hands will be required to hold the wood tightly against the saw guide.—E. C. H.



The wooden saw guide attached to the miter gauge is faced with sandpaper so the work will not slip

Fast-Climbing Model Plane

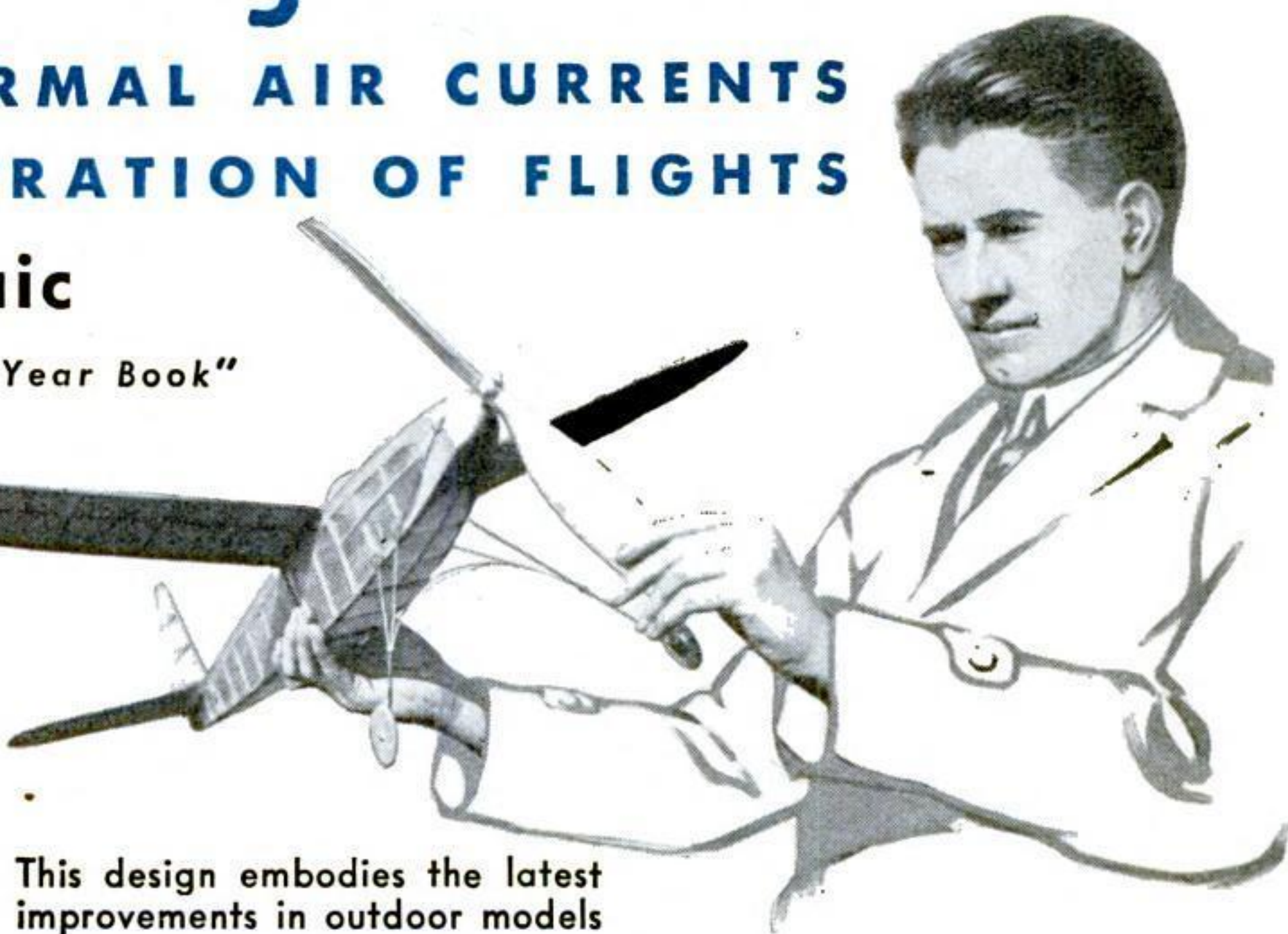
HUNTS OUT THERMAL AIR CURRENTS
TO INCREASE DURATION OF FLIGHTS

By Frank Zaic

Editor of "Model Aeronautics Year Book"

BECAUSE of the thorough testing it has received, you can be sure of the stability of this new 36" model airplane, Thermal Hunter No. 2. It is a powerful, high-climbing model that gets quickly into the air where thermals are more numerous. At the same time, it is of sturdy construction and won't readily crack up.

As an example of the importance of testing, it will pay the student of model aërodynamics to study carefully the slight differences between the photos and the working drawings. The photos were taken during construction and just before test flying, while the plans show the modifications which were made as the result of the tests. The rudder area had to be increased to make the model perfectly controllable. Although correct rudder area is very important, we have no way at the moment of calculating it accurately in advance. Another addition was a central spar in the stabilizer. The center section of the

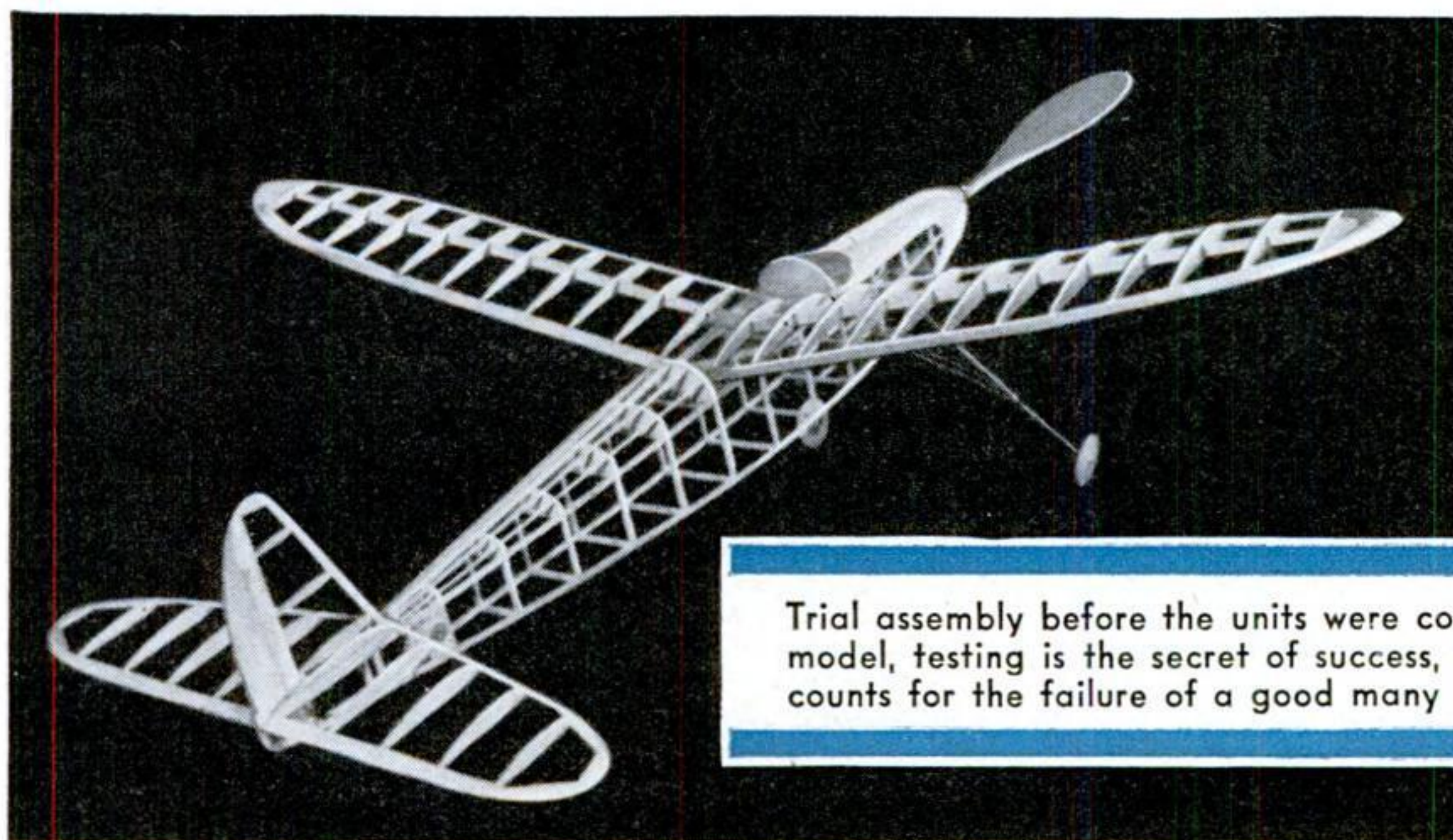


This design embodies the latest improvements in outdoor models

wing was also covered with sheet balsa to protect it from the rubber binding. These seemingly minor points count a great deal.

Fuselage. Lay out full-size side views on paper and make the two sides. Daub the brace and longeron junctions on the working drawings with soap to prevent fuselage sides from sticking to the paper. Cut the semi-round bulkheads. Cement bulkheads and front stringer in place. Cover front portion with 1/32" balsa and insert turtleback stringers. Make landing gear and rubber anchorage as shown. If you cannot obtain large face bushings, use tubes, but cement and bind them with silk to the longerons. Cover fuselage. Yellow paper was used on the original.

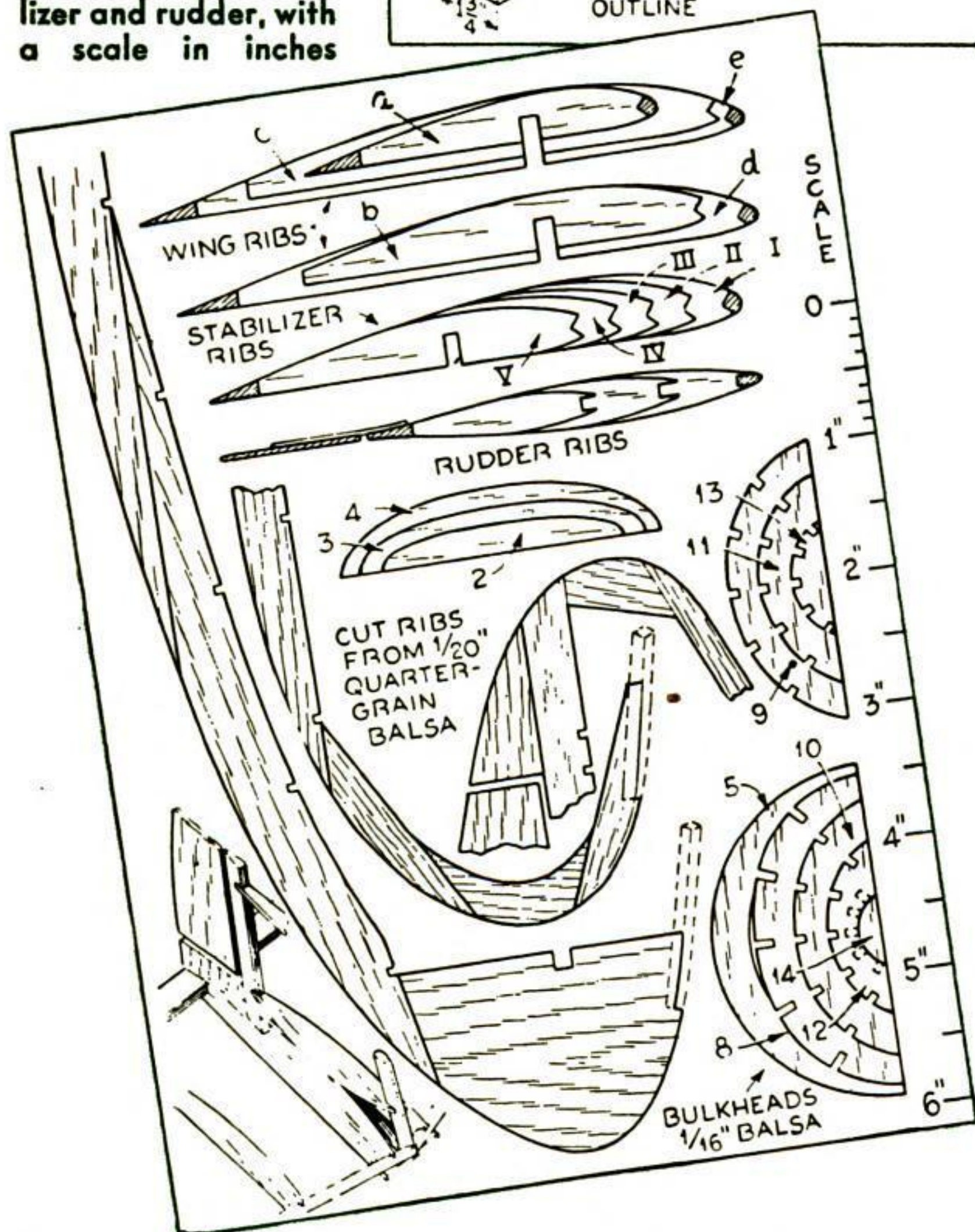
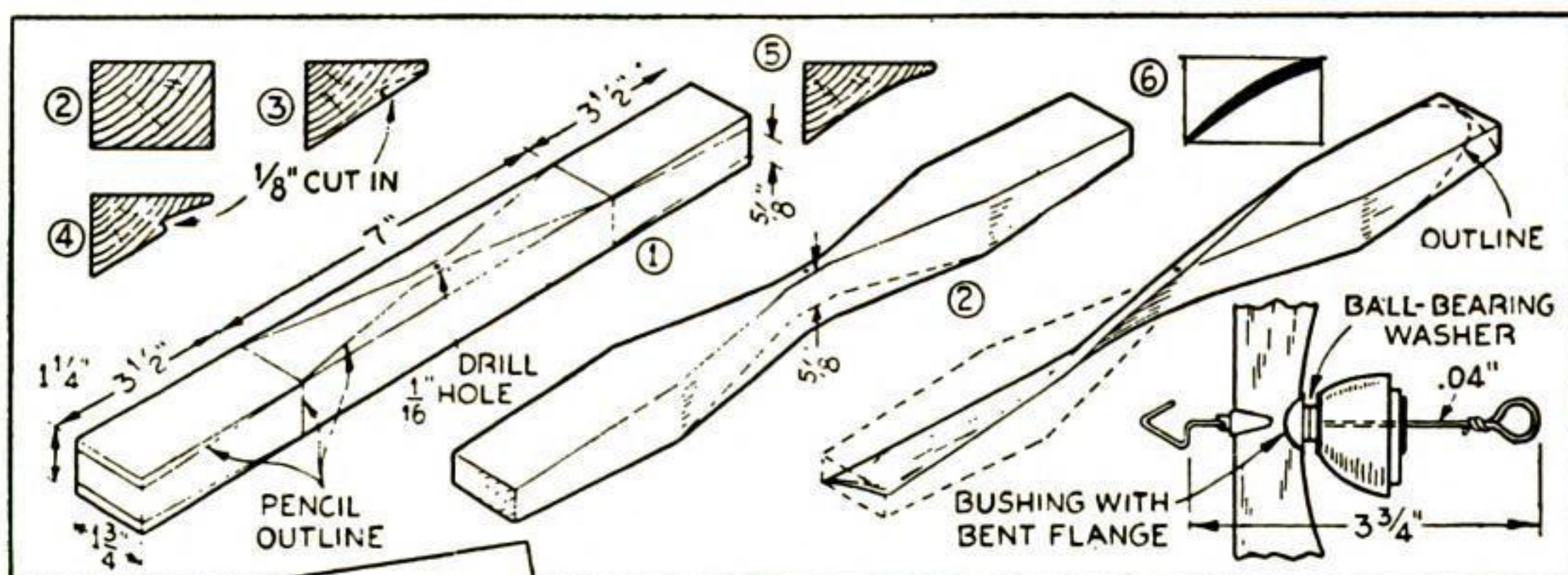
Wing and tail surfaces. Make the wing in two halves, join carefully so both sides will have equal lift, and use cement generously. Cover upper or curved side first. Be sure that the paper grain is spanwise. Daub center portion of wing with



Trial assembly before the units were covered. In building any model, testing is the secret of success, and the lack of it accounts for the failure of a good many kit-constructed models

The propeller blank, steps in shaping it, method of applying the shaft and fixing it to the nose plug

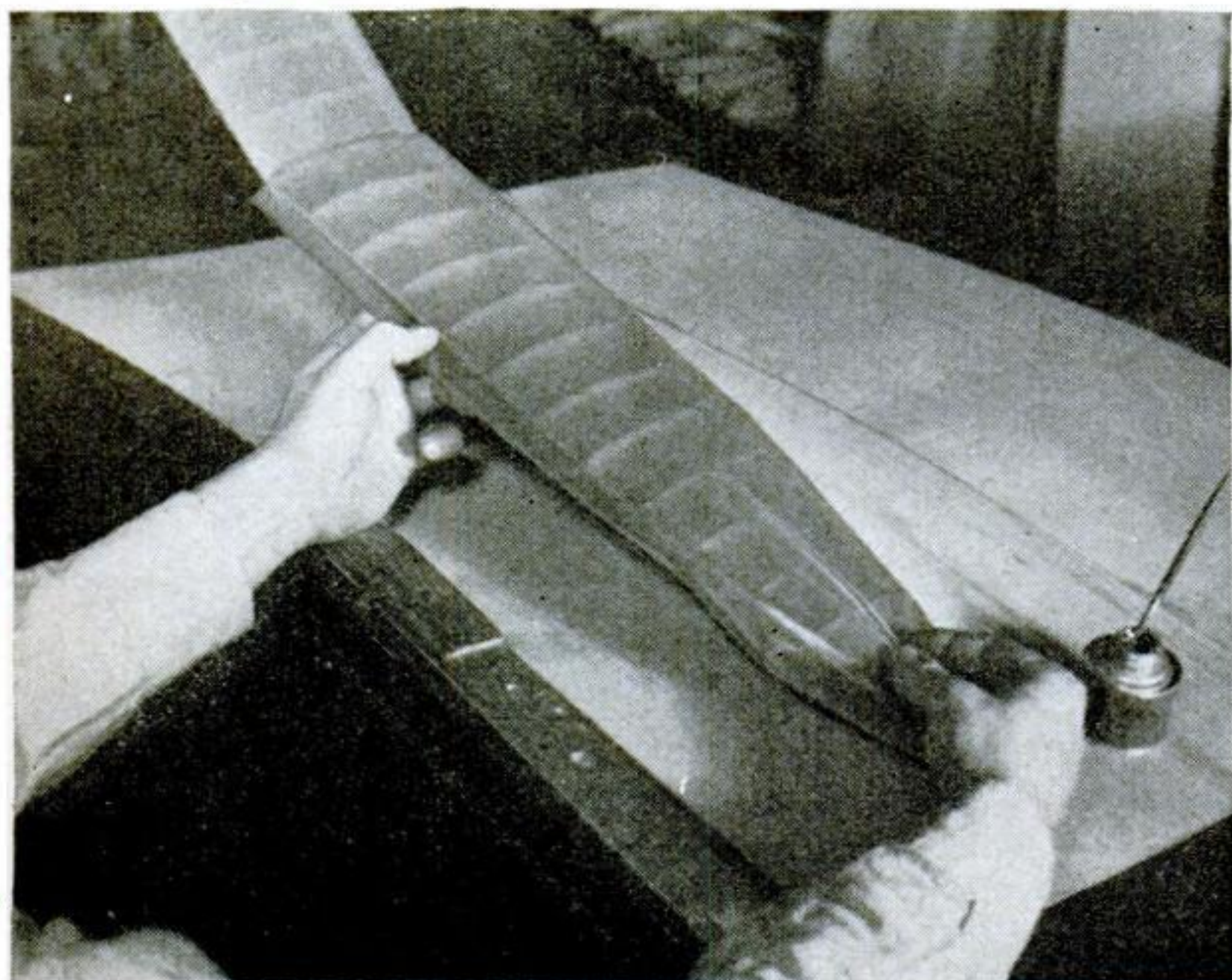
Below are the ribs, bulkheads, and tips of the wings, stabilizer and rudder, with a scale in inches



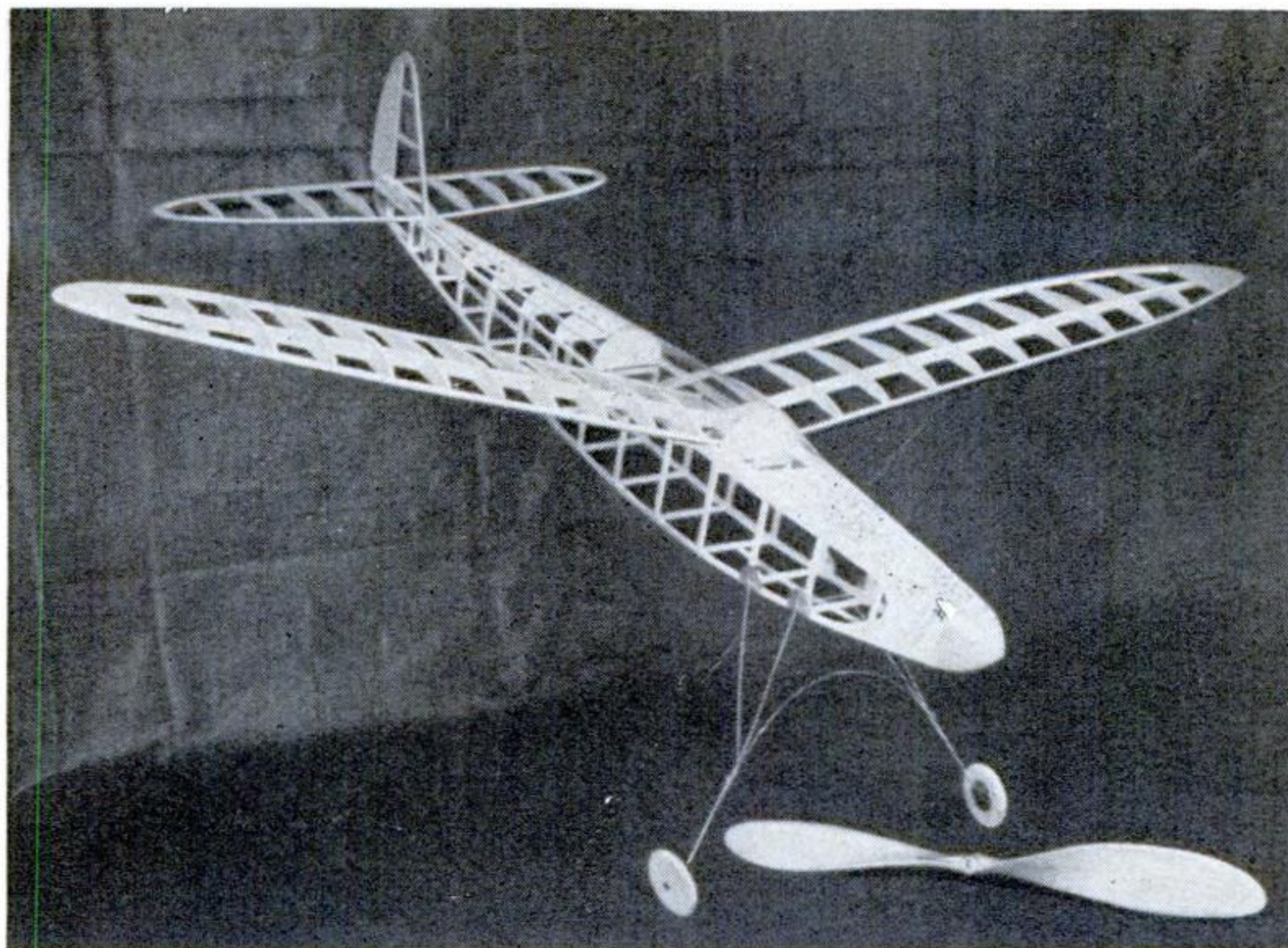
dope and spread one end of the paper over it. When set, brush the end rib and leading and trailing edges with dope. Pull the paper towards the wing tip by holding the free end between fingers and palm, the fist being clenched. Grasp the paper somewhat short of the wing tip so that you can stretch it by pressing the knuckles against the tip. While it is stretched spanwise, smooth the wrinkles with the left hand. Spread the paper along the ribs by placing the hand on the center of a rib and gliding the fingers and thumb away from each other towards the spars. Follow this procedure on all surfaces. The difficulty of getting a perfect job on the tips can be lessened by moistening the paper, but be careful not to tear it. Use red paper for wing and stabilizer, and yellow for rudder. Finish by spraying with water, then doping. Apply dope only on a dry day, otherwise it will be subject to "blushing."

Propeller and plug. Use hard balsa and follow the dimensions and steps in carving exactly. The final shaping should be done with sandpaper. Finish the prop with No. 10/0 sandpaper and apply four or five coats of half-and-half mixture of cement and dope.

Assembling and flying. The wing has an incidence of $\frac{3}{8}$ " and is well forward. The center of gravity is at the one-third chord point. The stabilizer is set at a minus incidence of $\frac{1}{8}$ ", while the propeller has a right side thrust of $\frac{1}{16}$ " obtained by offsetting the nose plug. This balanced set-up is safest as it does not require critical



Full-size patterns of ribs, bulkheads, and tips of the wings, stabilizer, and rudder of Thermal Hunter No. 2 are available for 10 cents; a complete blueprint with half-size assembly drawings, for 50 cents.



View of the uncovered framework from the front showing landing gear and prop

adjustments, and slight rudder adjustments will control the direction of the model. Loop a rubber band over the stabilizer and under the fuselage to hold the stabilizer and rudder

to the fuselage. A pin keeps the band in place.

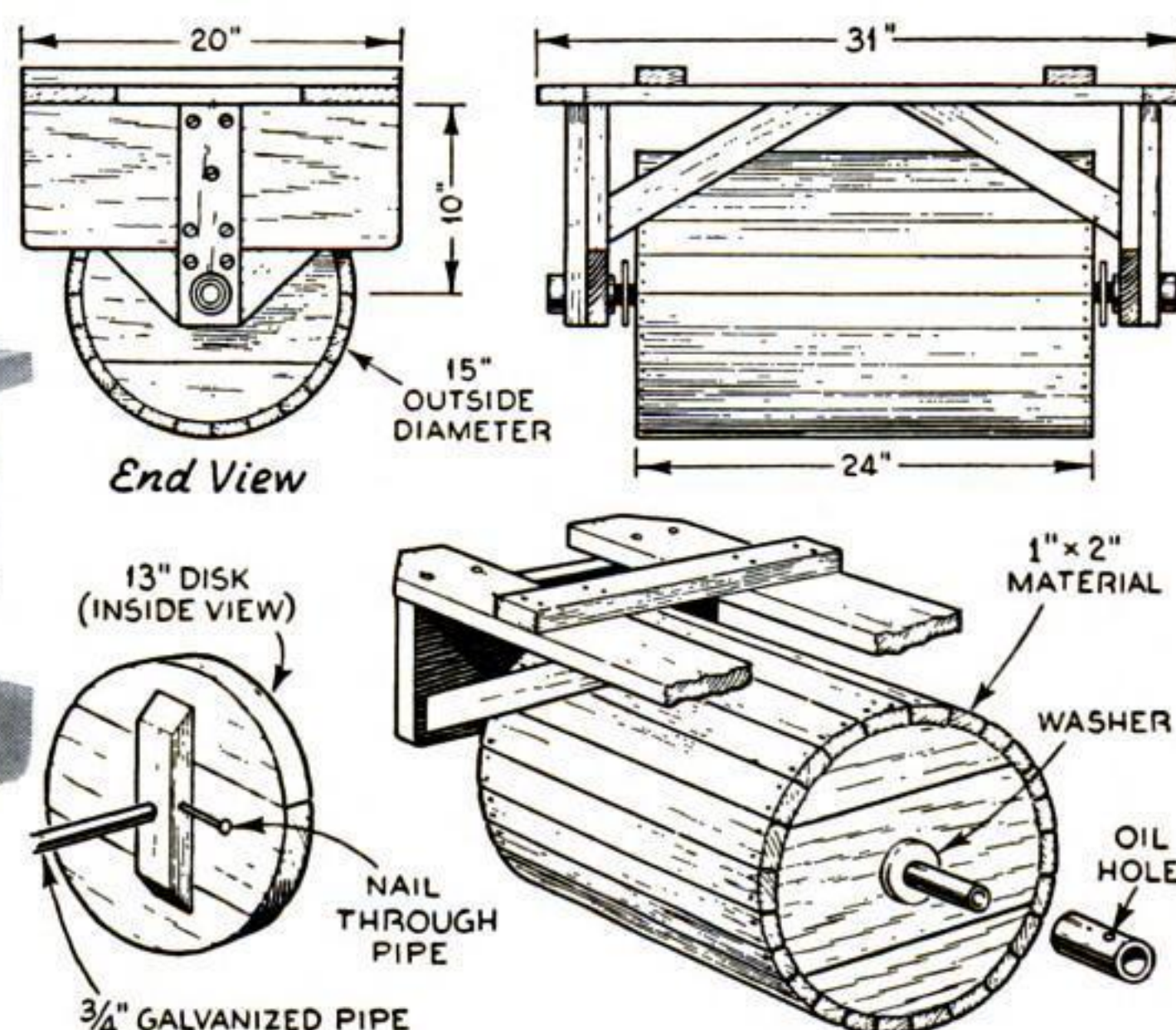
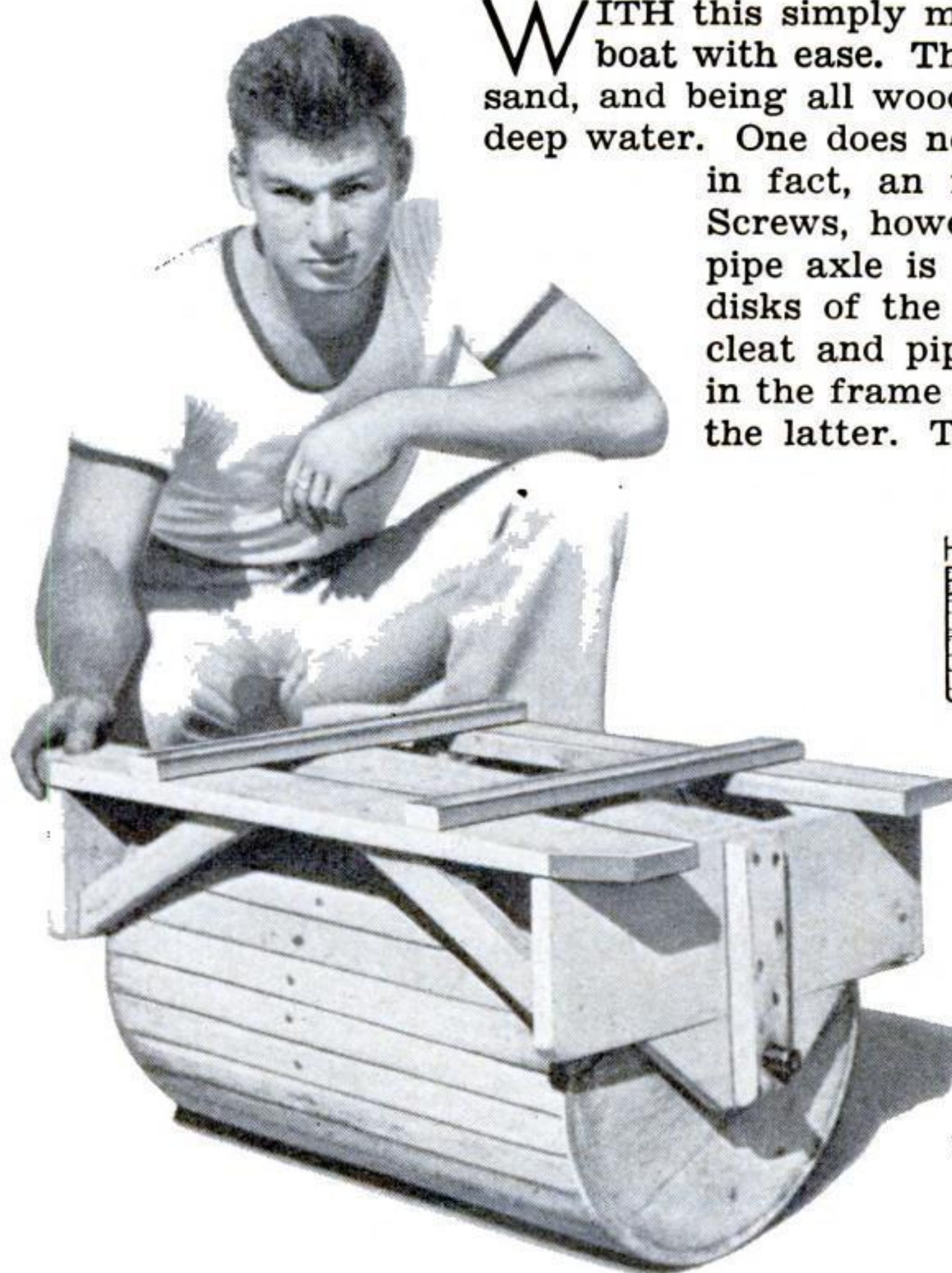
The rubber motor consists of twenty strands of $\frac{1}{8}$ " brown rubber 24" long. It is pulled through the fuselage by a string or wire hook. Be sure to fix the wire pin so that it will not slip out. The best lubricant for the rubber is a mixture of two parts green soap and one part glycerin with a little water. Be sure to have the rubber slack so that it will not pull back on the propeller shaft; this is especially important when a spiral type of free-wheeling device is used, otherwise the prop will act as a rudder and

bring the model down in a spiral.

Start the model with a few turns, make corrections, and slowly increase the number of turns up to a maximum of about 768.

Simply Made Wooden Dolly for Launching a Rowboat

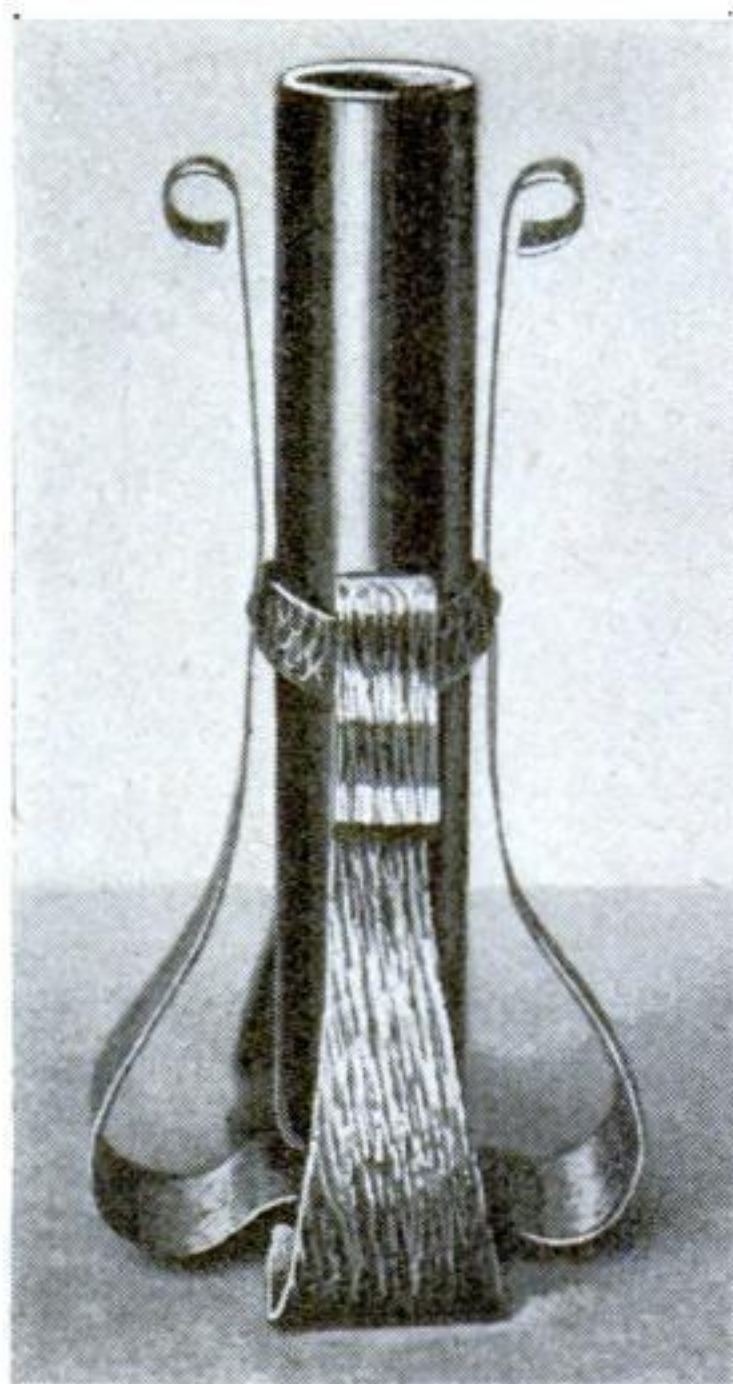
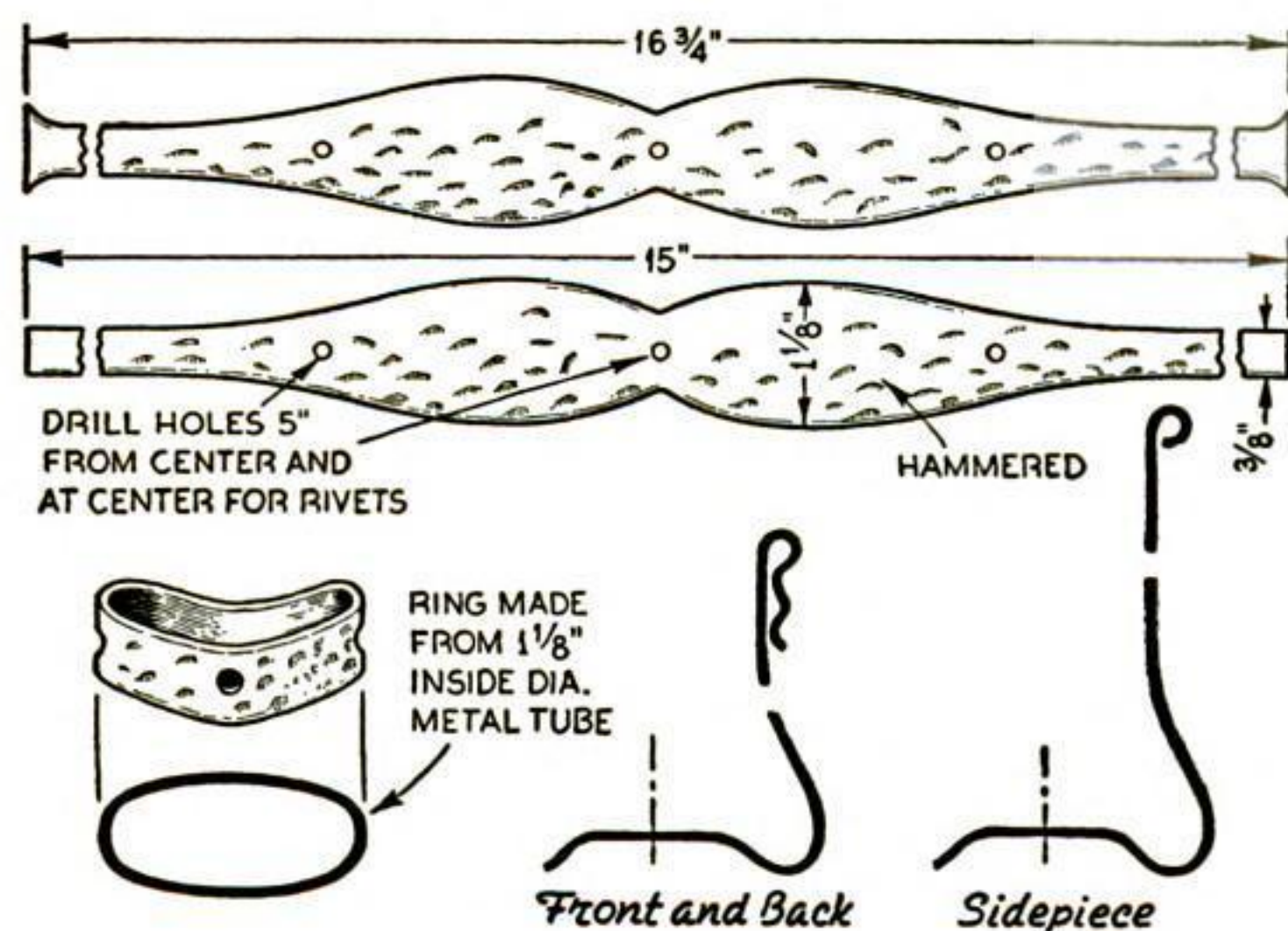
WITH this simply made dolly, one person can handle a 12' rowboat with ease. The wide tread prevents sinking into the beach sand, and being all wood, it floats out when the boat is pushed into deep water. One does not need to use surfaced lumber for this job; in fact, an inferior grade of pine will be satisfactory. Screws, however, should be galvanized, and a galvanized pipe axle is recommended. The latter is secured to the disks of the roller by means of a spike or pin through cleat and pipe, and short lengths of larger pipe are set in the frame to serve as bearings. An oil hole is drilled in the latter. The cleats on top are made to suit the boat.



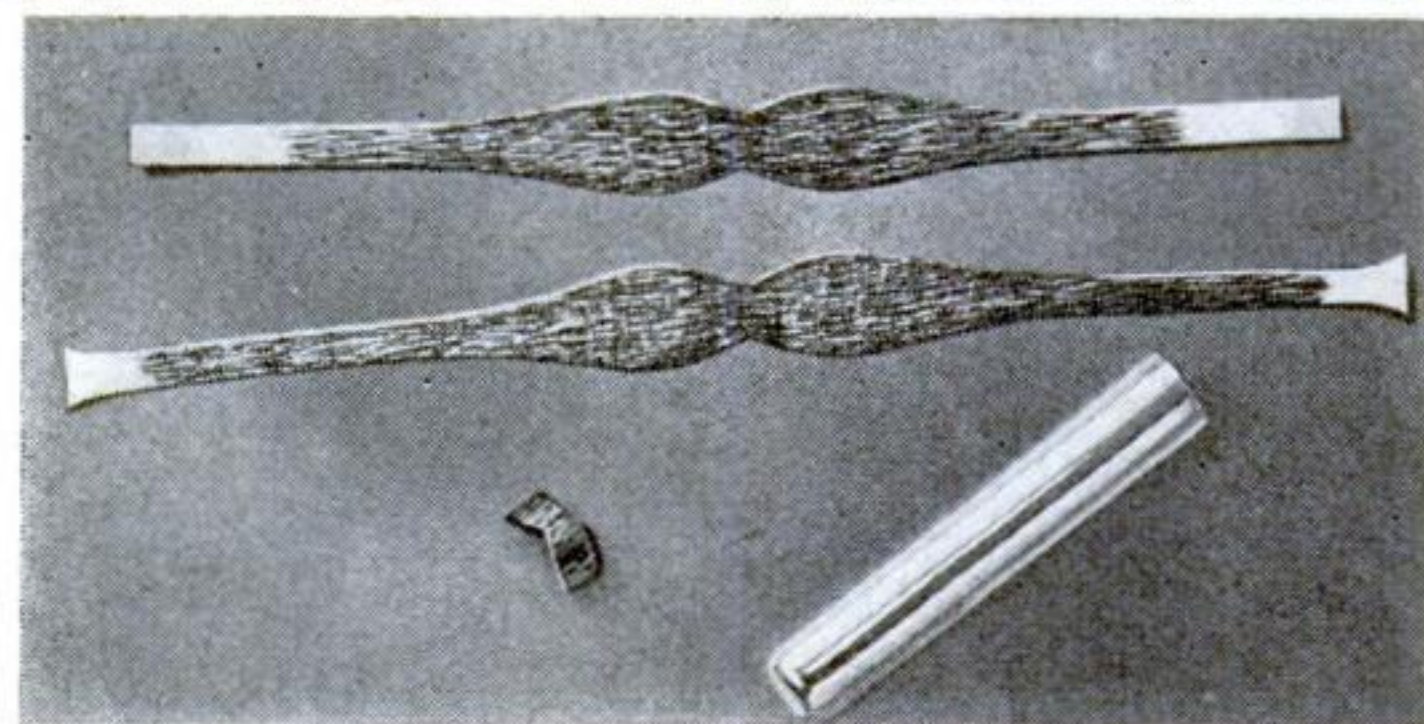
Glass Toothbrush Tubes Turned into Bud Vase

DISCARDED glass toothbrush containers can be converted into attractive bud vases by making holders from 18-gauge soft sheet copper. For each holder, cut two pieces of copper as indicated below and hammer one side lengthwise with a riveting hammer to give a heavily grained effect. The ring for binding the pieces together at the top is made from a short piece of thin-walled brass or copper tubing, bent to conform to the oval shape of the glass tube. Holes are then drilled, and the holder is assembled with rivets.

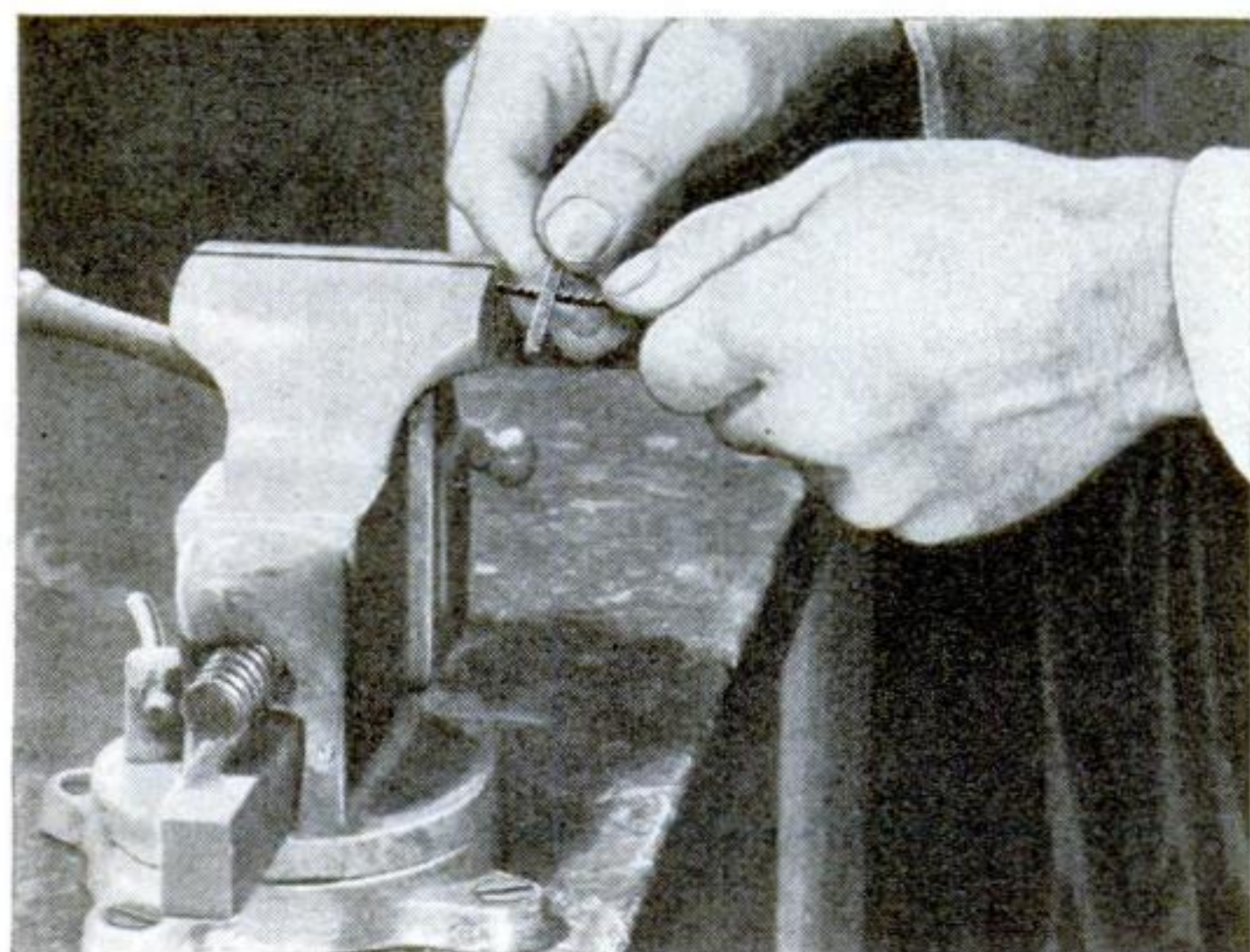
Clean the piece carefully, immerse it in a solution of liver of sulphur, and leave until brown. Wash it thoroughly, let it dry, and polish and lacquer it. The glass tube may be left clear or finished in bright red lacquer or any other color desired before being slipped into the copper holder.—DICK HUTCHINSON.



Left, the finished holder; below, how the parts are shaped and bent

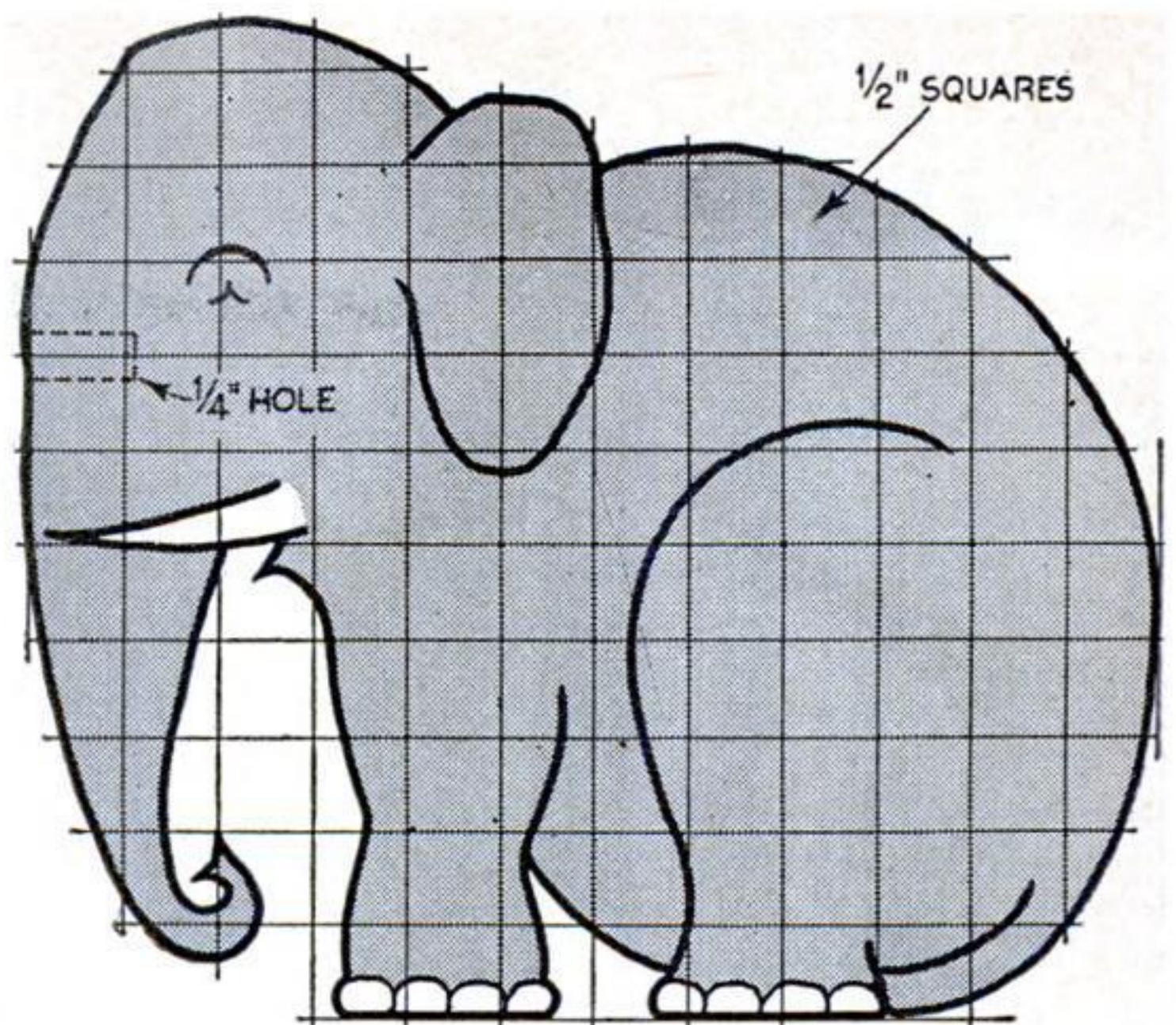


Jig-Saw Blades Cut More Smoothly After Being Filed



COPING and jig-saw blades will cut faster and a good deal more smoothly if the teeth are carefully filed. Clamp the blade in a vise with about $\frac{3}{4}$ " of the teeth projecting, and grasp the end with the left hand. It is best to hold a finger directly under the part being worked on. Blades less than $\frac{1}{16}$ " wide can be sharpened in this way. A needle file is just the thing for the job, although a very small saw file will do.

If you use wide jig-saw blades, they can, of course, be held as in a regular saw vise, and can be resharpened time after time. The filing is so quickly done that the time lost is nothing compared with that saved in faster and better cutting.—E. M. L.



Pink Elephant Costumer

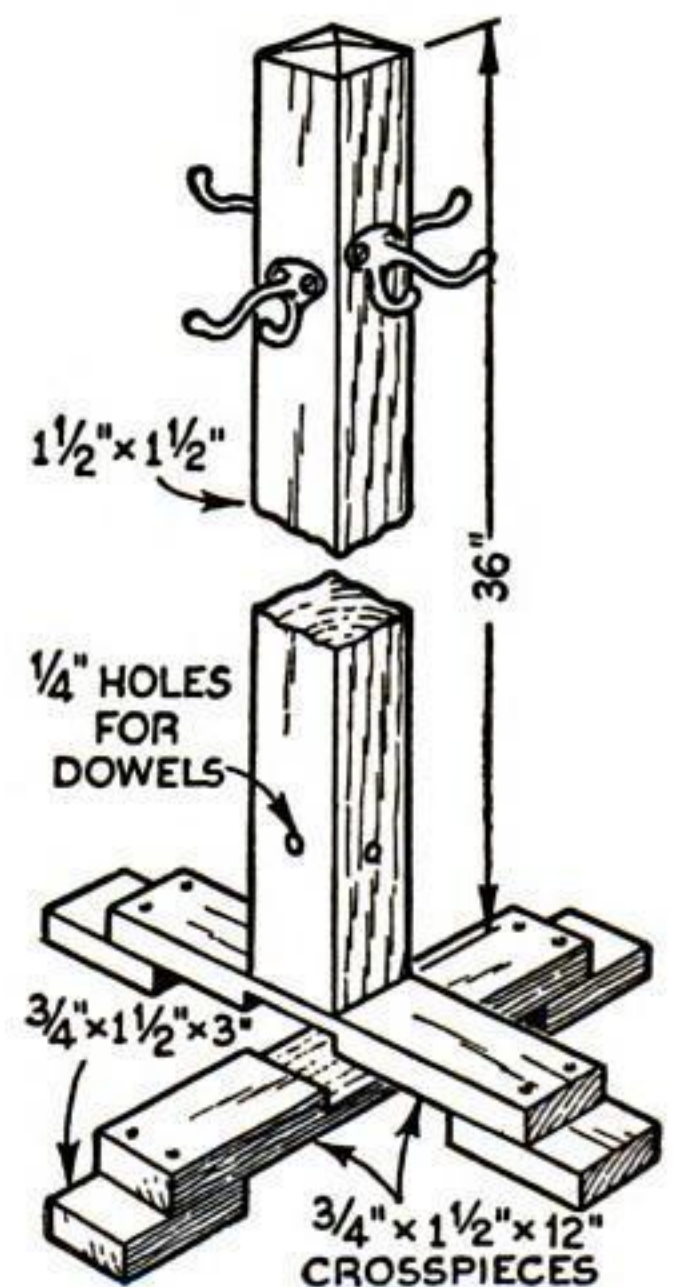
APPEALS TO CHILDREN

THIS costumer, with four pink elephants at its base, will appeal to children and aid in training them to be tidy about hanging up their clothes.

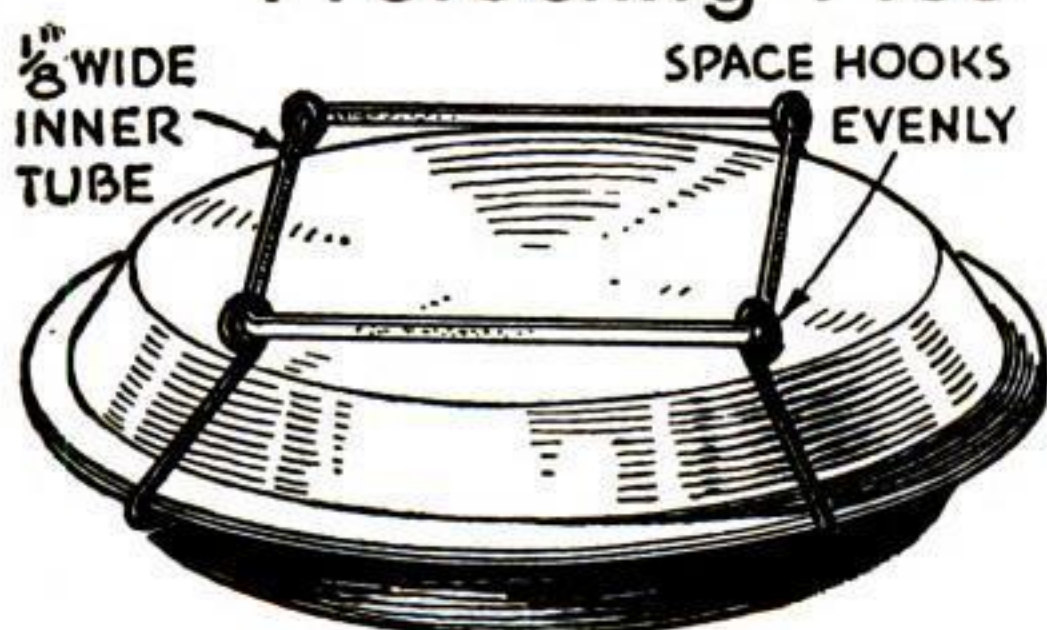
The elephants are scroll-sawed from $\frac{3}{8}$ " plywood with a fine-cutting blade. The upright piece is of $1\frac{1}{2}$ " square stock, beveled from all sides at the top. Fasten the two crosspieces at the bottom with a half-lap joint and attach to the upright with a heavy 2" wood screw. Holes are drilled in the trunks of the elephants and also in the upright so that the

elephants can be fastened to the tree with $\frac{1}{4}$ " dowels. A small screw through each of the bottom crosspieces and into the hind legs of the elephants will then hold them securely.

Small clothes hooks are fastened to each side of the tree, and rubber-headed tacks are placed on the bottom of the crosspieces. Paint the costumer before assembling. A good color scheme is obtained by painting the tree ivory and the elephants pink, outlined in black. The tusks and the toes are white.—FRANK MCCARTY.



Protecting Pies While Being Carried to a Picnic



Wire clips and a rubber band hold the two pie tins securely together

CUSTARD, lemon, and other equally fragile pies may be safely carried on a picnic or other outing by the method illustrated at the left. All that is required is an extra pie tin, four clips bent from bailing wire, and a narrow width of rubber cut from an old inner tube. The clips are shaped as indicated to hook over the edges of the pie tins, and the other ends are looped over the rubber band. The pie is left in the tin in which it was baked, the extra tin is inverted over it, and the clips are snapped in place. Always carry the pie right side up, of course.

YOU'LL FIND IT EASIER
THAN YOU THINK TO MAKE

Well-Fitting

By
William Harnden
Foster

Principal elements of the mainsail of a small boat. A jib is made in the same way except that it does not require any headboard

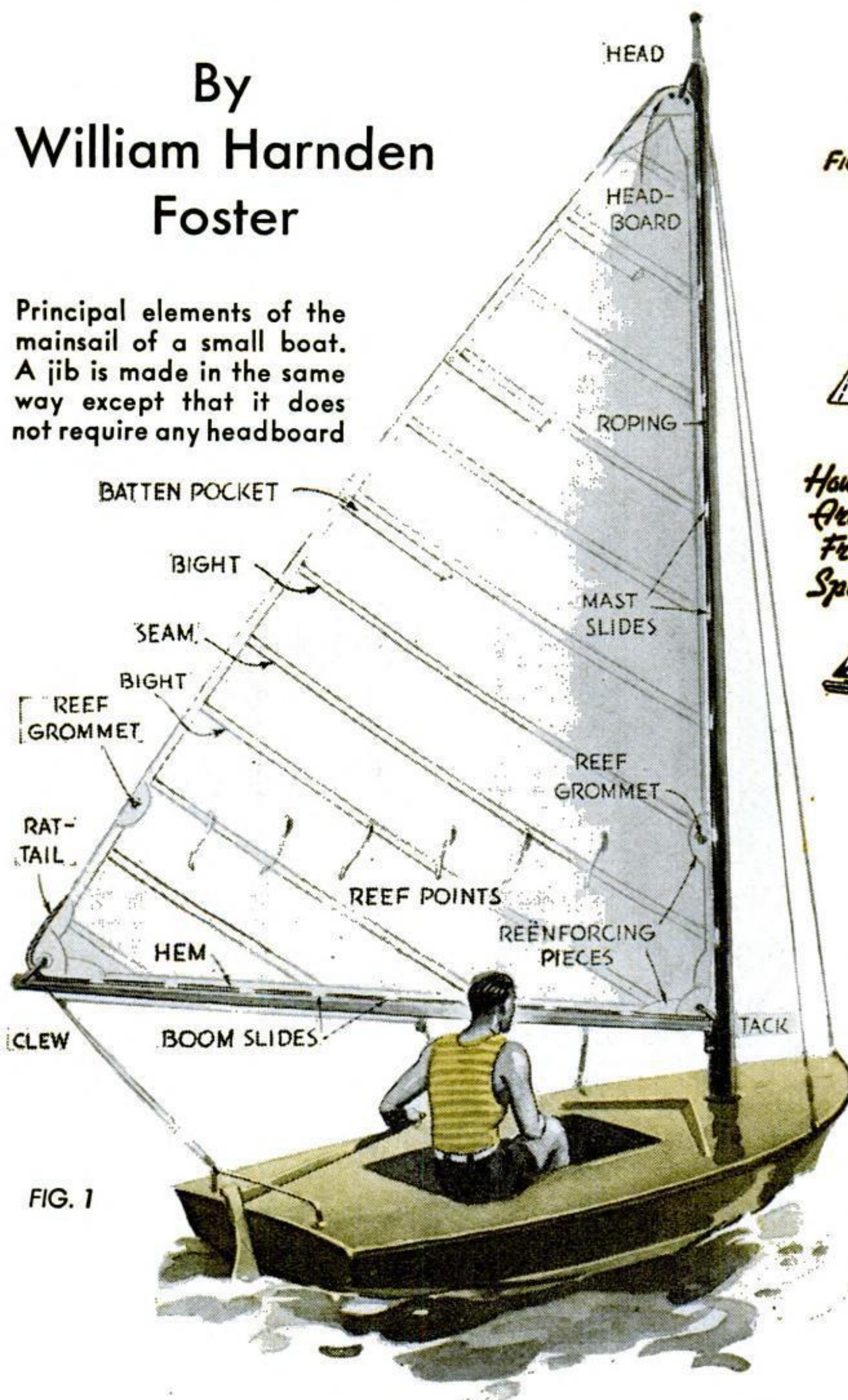
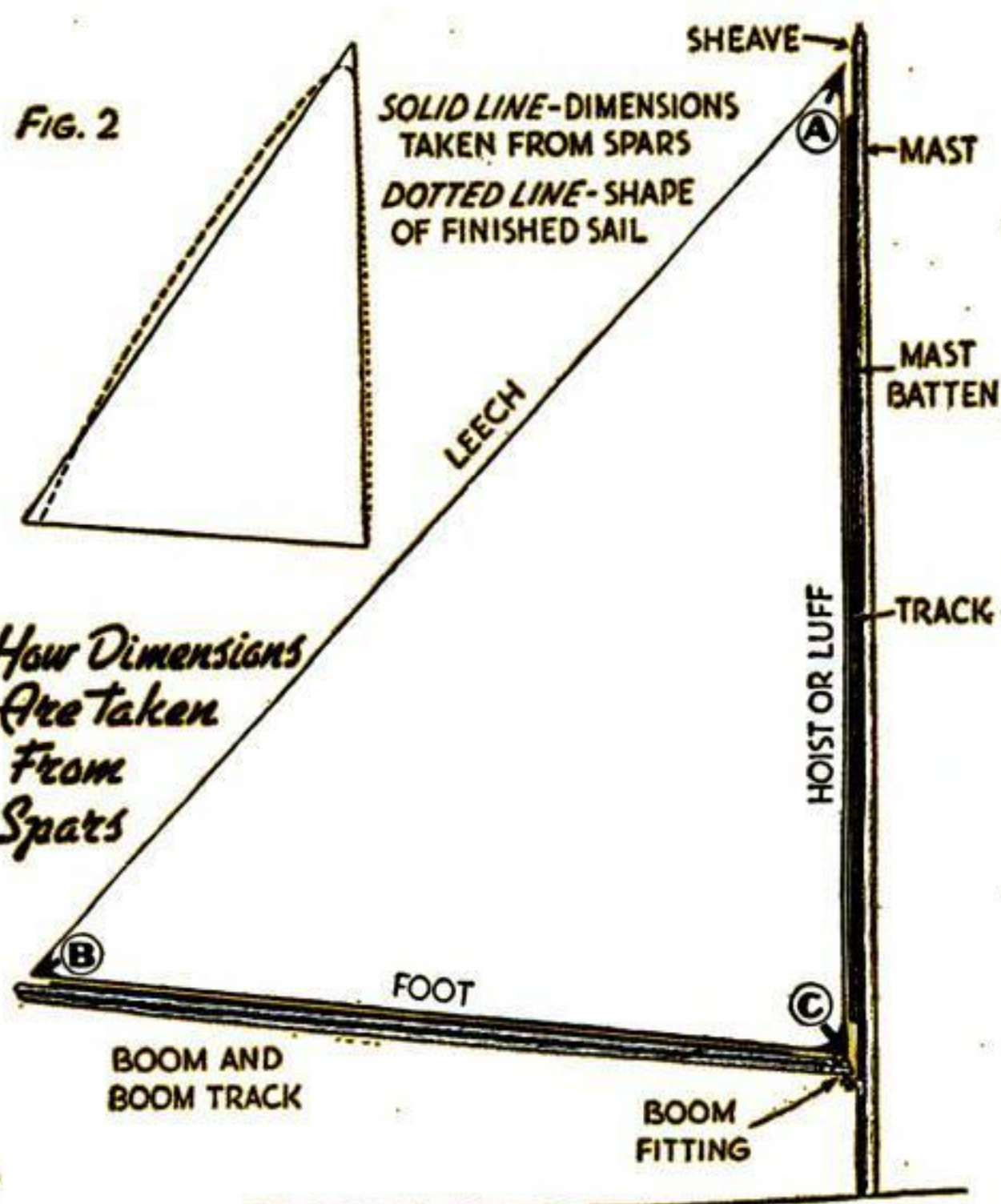


FIG. 1

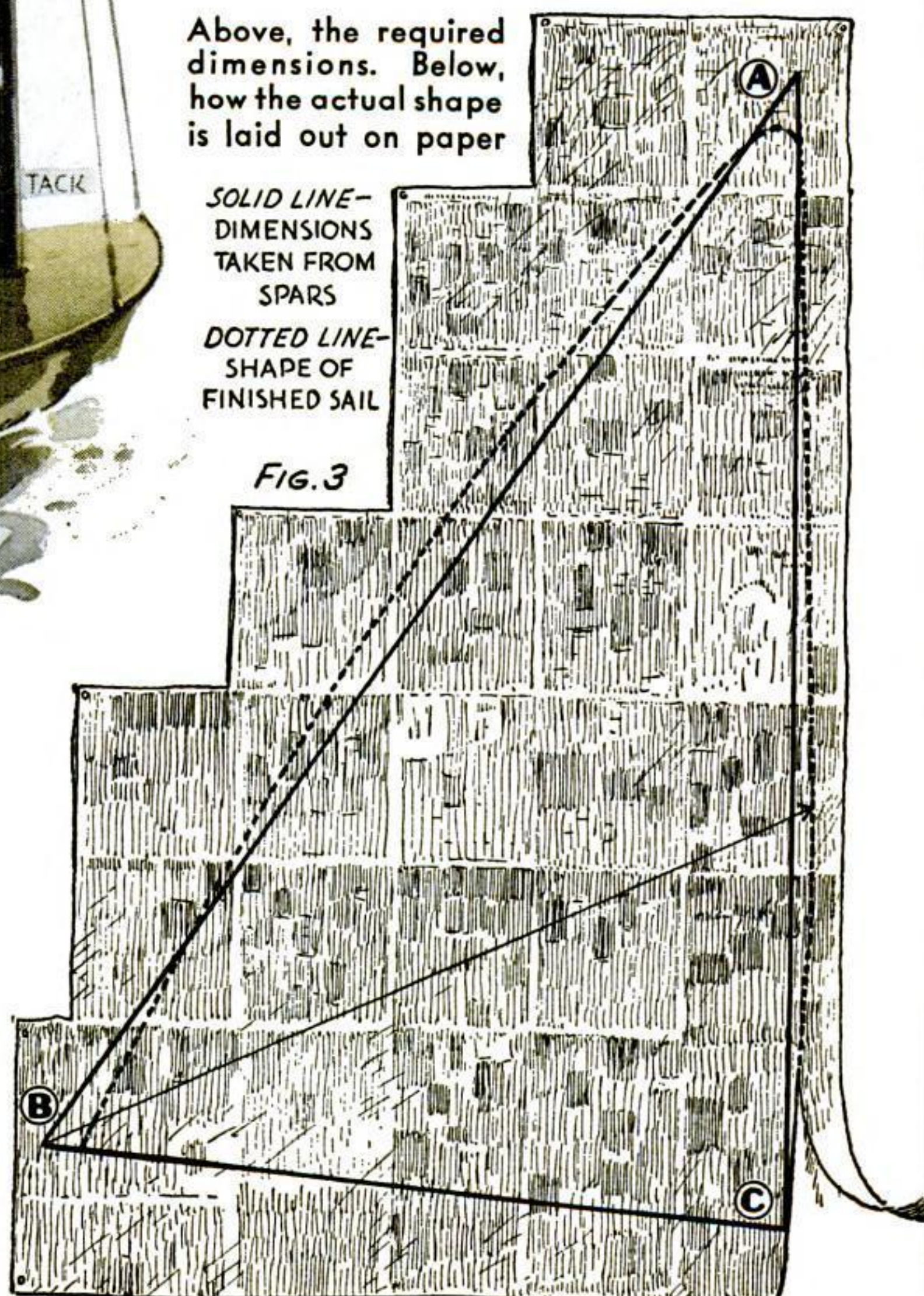


*How Dimensions
Are Taken
From
Spars*

Above, the required
dimensions. Below,
how the actual shape
is laid out on paper

SOLID LINE-
DIMENSIONS
TAKEN FROM
SPARS
DOTTED LINE-
SHAPE OF
FINISHED SAIL

FIG. 3



GREAT sails such as the mainsails, spinnakers, and Genoa jibs of big yachts call for a sail-making art far beyond the amateur, but he can, nevertheless, cut and sew well-fitting, serviceable sails for any small boat. In this work it is better to follow a few safe and simple methods than to make a botch of the job by trying to copy the involved practices of the professional sailmaker.

A mainsail with an area up to 100 square feet is best made of good quality 4-oz. sail duck. This comes about 39" wide and can be obtained from any large yacht supply concern. The sail must be lapped and bighted to

SAILS for a SMALL BOAT

provide sufficient strength. The edges must be cut with certain curves or roaches to give style and finish and a contour that will best turn wind pressure into driving force. The sail must be reënforced at the corners and bound or bolt-roped on two sides for strength, and it must be equipped with slides with which to attach it to the mast and boom. For the topography of a finished small boat mainsail, see Fig. 1.

The first step in making a sail is to take accurate measurements from the spars of the boat or from the sail-plan drawing. The dimensions taken should be those of the finished sail as it will be when fully stretched by use. The dimensions you need are for the hoist (AC), the foot (BC) and the leech (AB) in Fig. 2.

Although a professional does not do it this way, the amateur should make a full-size

With the full-size paper pattern as a guide, the material is lapped, bighted, creased, and stitched as at the right. The hems are then folded in and sewed

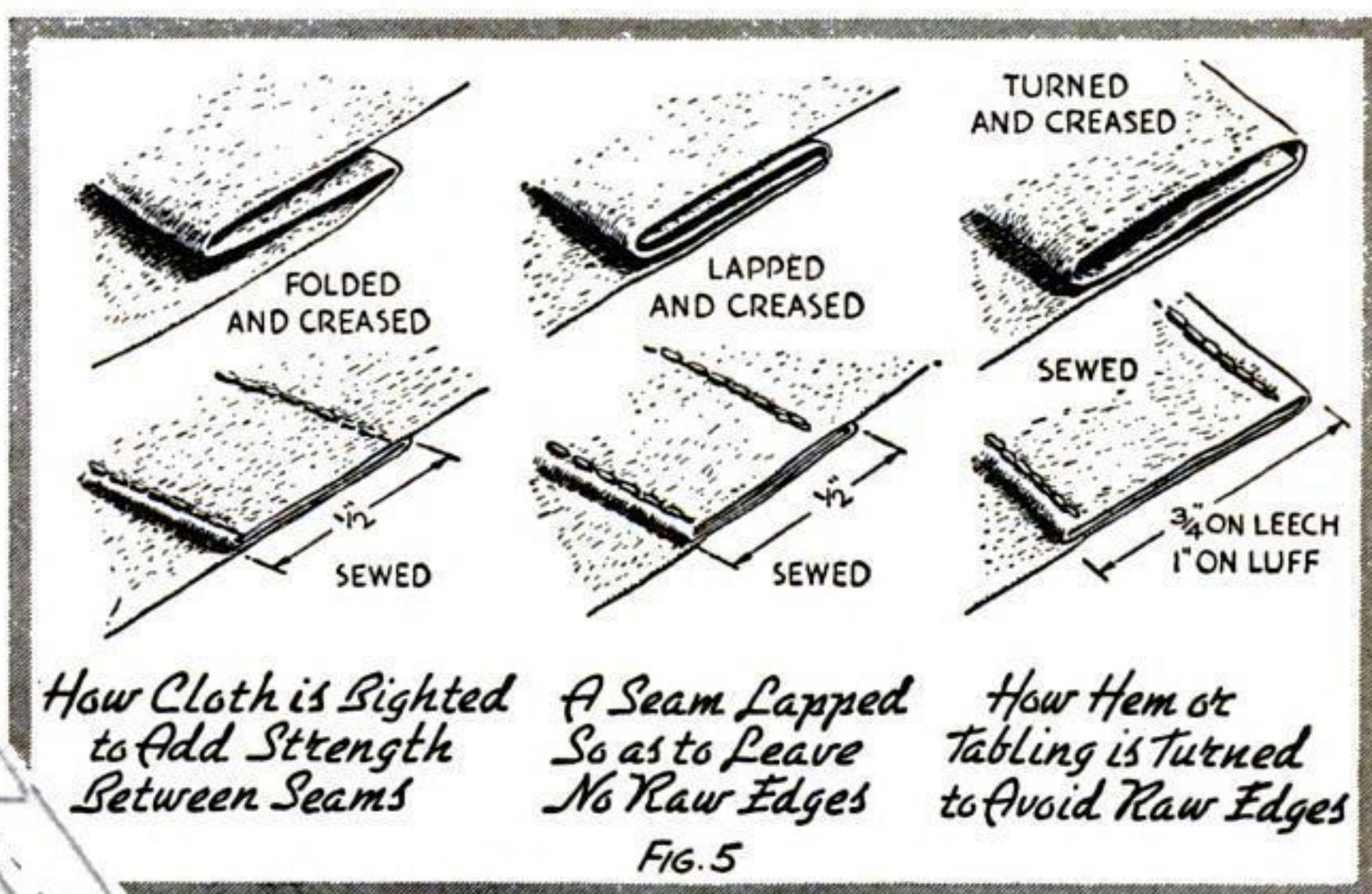
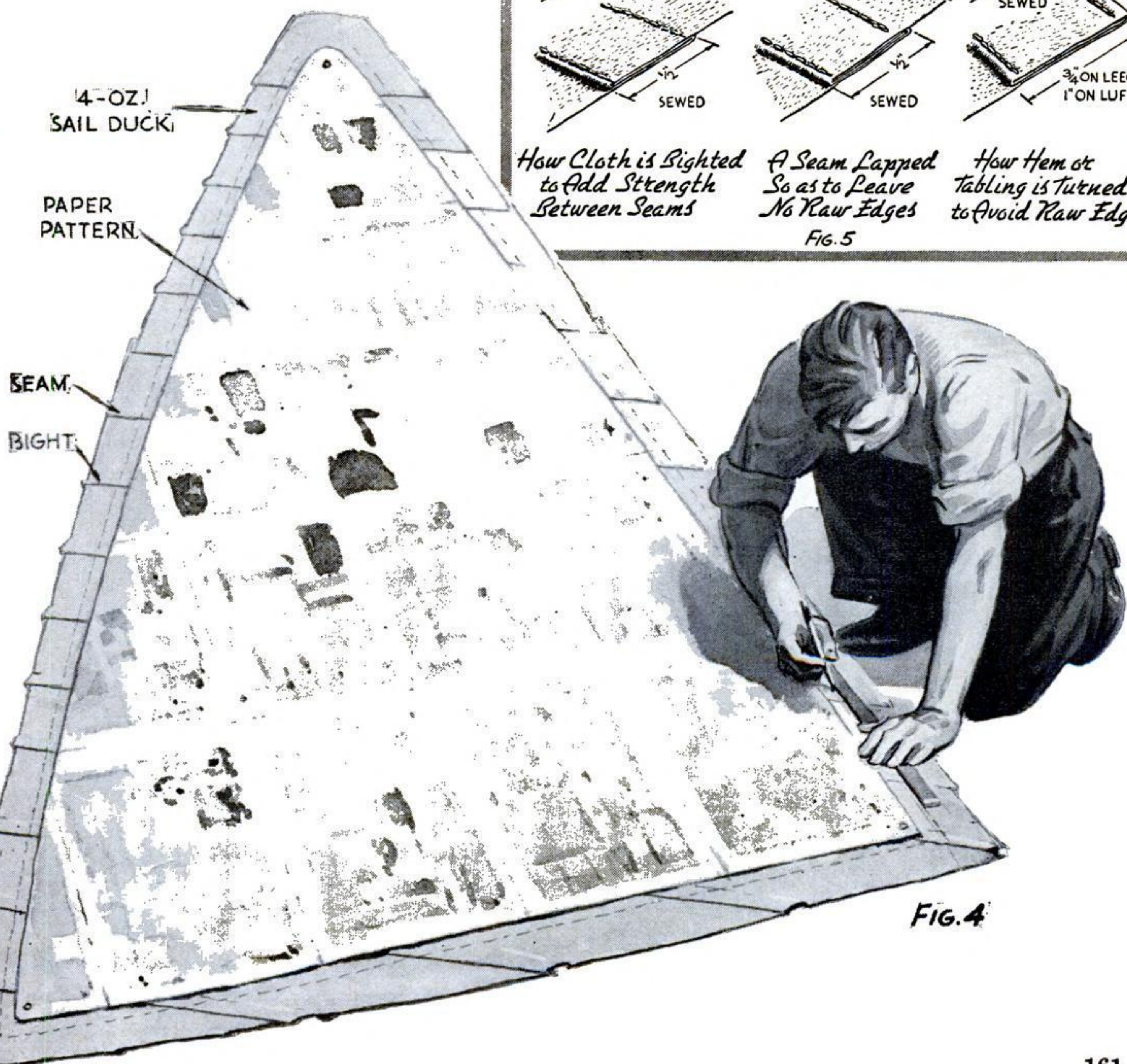


FIG. 4

paper pattern of the sail. Newspapers, if pasted carefully together, will serve the purpose, but stouter wrapping paper would be better. When the big triangular sheet of paper thus formed is smoothed out on the floor, the lines *AB*, *BC*, and *AC* are transferred to it (Fig. 3). Now, because the sail will stretch about $\frac{3}{8}$ " to the foot after use, the line of hoist (*AC*) must be made that much shorter to allow for this. The same proportionate allowance must be made along the boom (*BC*). To give the sail the necessary curve in its surface to furnish driving power, the line *AC* is given a slight convex curve amounting to about $\frac{1}{8}$ " to the foot on a small sail. The greatest amount of curve should be on a line bisecting angle *ABC*. To add area to the sail, the line *AB* is given a curve or roach of $\frac{3}{8}$ " to the foot, the greatest amount of curve being two thirds of the way from *B* to *A*. The foot of the sail is cut straight.

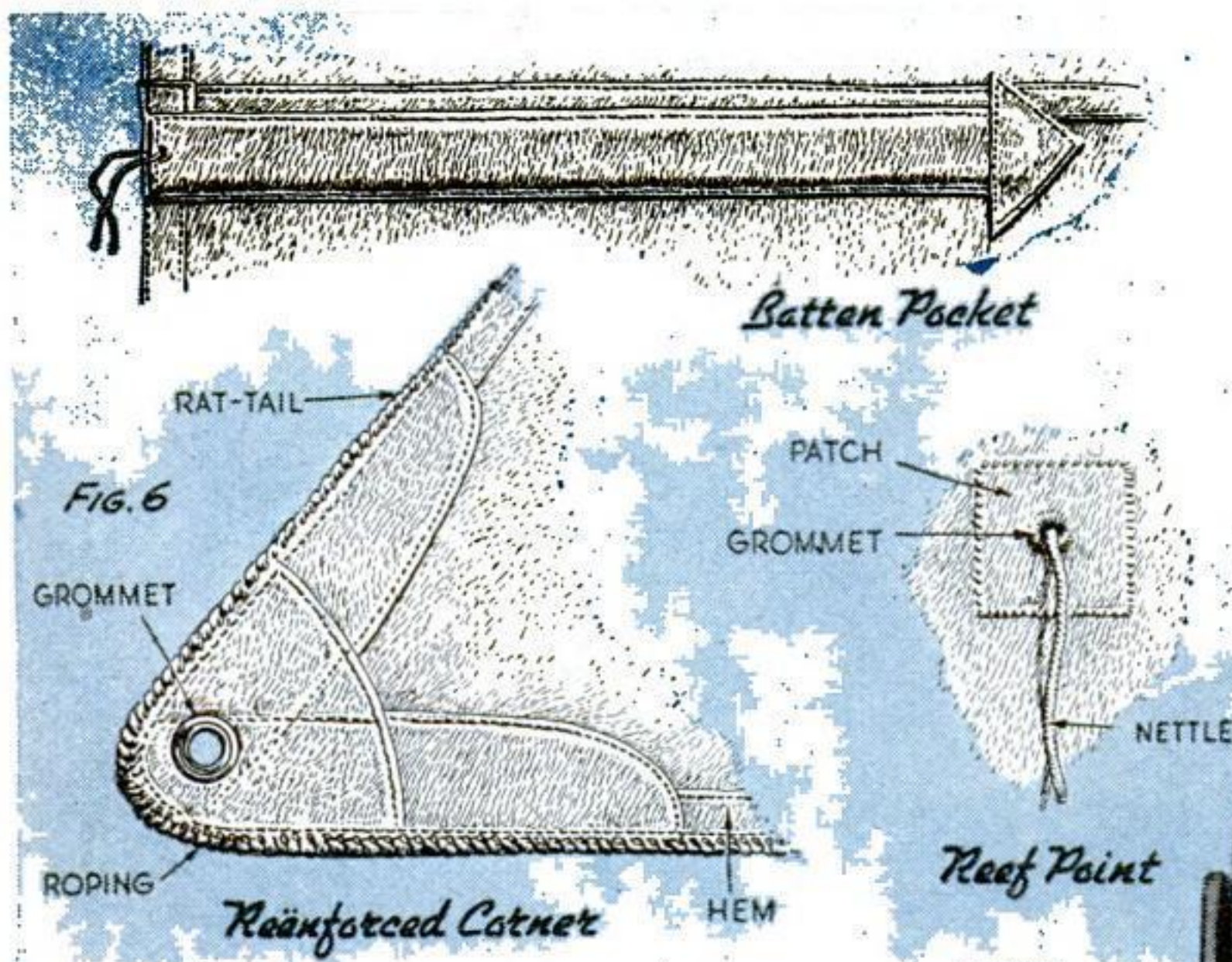
The paper pattern is then cut out and laid on the floor. The sail will be of the modern crosscut type, so slip under the paper pattern a length of the cloth with the lower edge at right angles to the leech (*AB*) and passing close to the tack (*C*). Allow enough material beyond the pattern to provide for the shortening caused by lapped seams and the bight down the middle and for the hems. Mark on the pattern where this cloth crosses; then cut off the material, remove and turn over and crease each edge $\frac{1}{2}$ ". Also crease in the bight down the middle (see Figs. 1

and 5). Now put the cloth back under the pattern and cut and crease the next piece above, and continue in this way until you have all the required material lapped, bighted, and creased as shown in Fig. 4. A flat-iron may be used to crease the material. If necessary, the laps and bights can be pinned together for sewing.

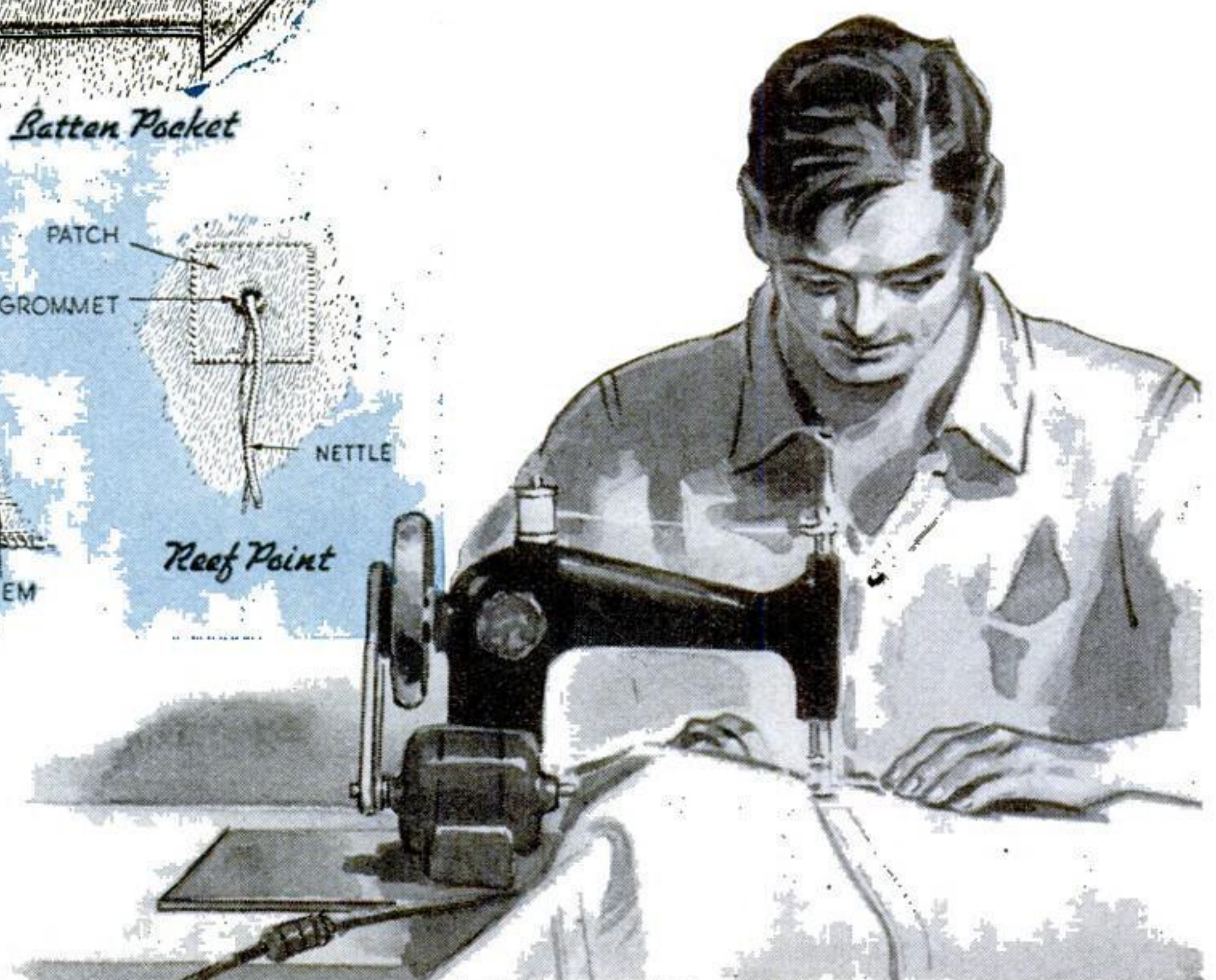
The sewing is done on an ordinary sewing machine with No. 12 cotton thread both in the bobbin and on top. Set the machine for ten or twelve stitches to the inch. Figure 5 shows how the laps and bights are creased and stitched. Now fold in the hems, making them $\frac{3}{4}$ " wide on the leech and 1" wide on luff and foot. The sail should then be exactly the size of the paper pattern. Sew the hems as you did the laps and bights (Fig. 5). With scrap material reënforce the corners as in Fig. 6. Put $\frac{1}{2}$ " grommets, which can be obtained at any marine hardware store, in the corners of clew and tack. Make the head-board according to details given in Fig. 8 and sew it into the head of the sail, still conforming to the paper pattern, which determines the limits of the finished sail.

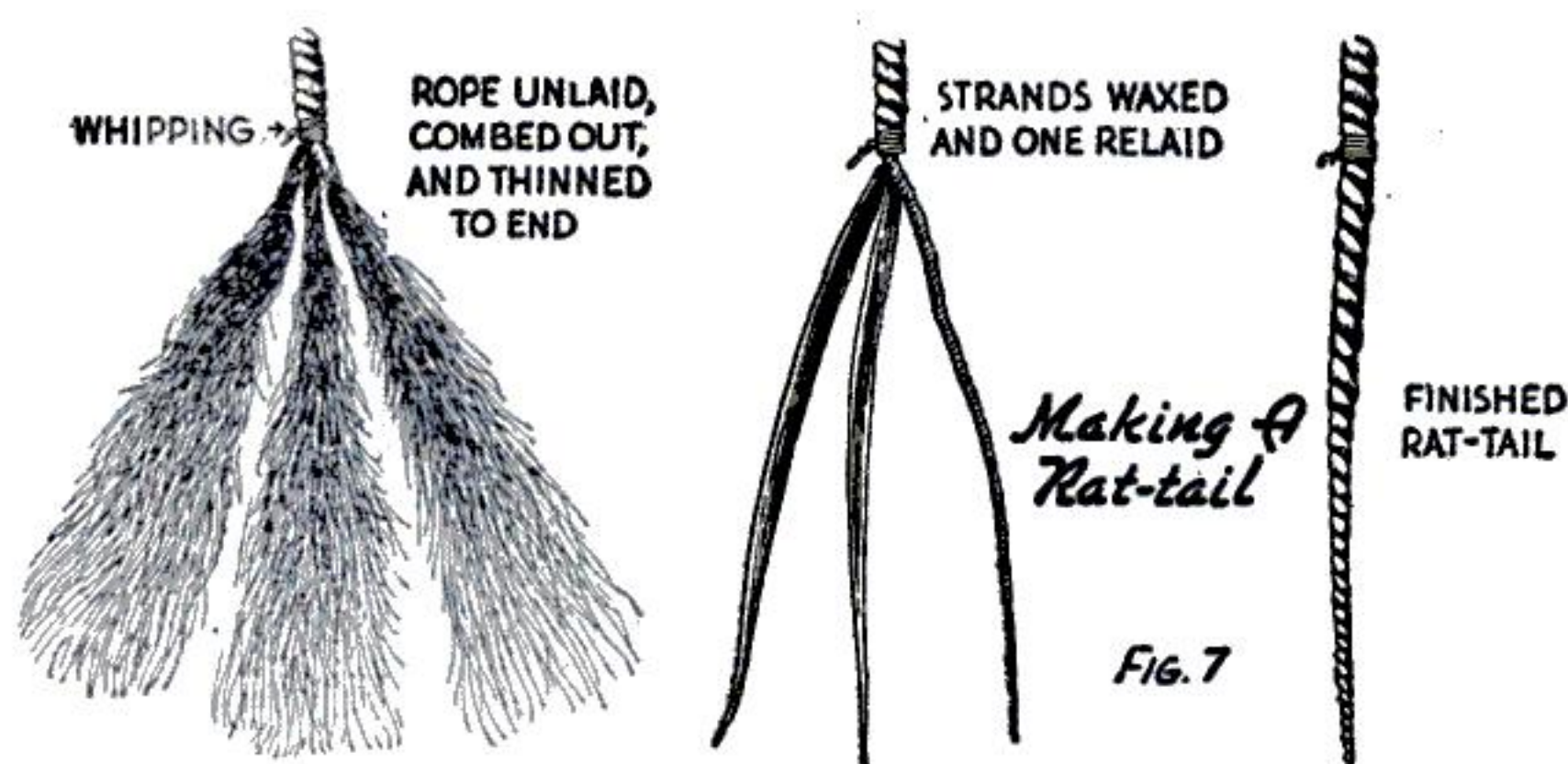
For the boltrope with which to bind two sides of the sail, you will need good quality, lightly-tarred rope made especially for the purpose and $\frac{1}{4}$ " in diameter. Make a rat-tail as shown in Fig. 7. This is done by whipping the rope 6" from the end and unlaying the three strands. Comb out each strand and with a knife scrape out the fibers toward the end until the strands come down to feather edge. Then wax each strand thoroughly with beeswax and lay it up again.

The boltrope goes on the port side



The bights and seams are stitched with No. 12 cotton on a sewing machine. Details of a batten pocket, reënforced corner, and reef point are shown above





Boltropes are finished off with a rat-tail at each end. The headboard is made and set in a pocket as at the right

of the sail with about half its diameter protruding beyond the edge. Stretch the bolt-rope by hand and loosen it up a little by turning it opposite to the lay. While still stretched, run a mark along the rope to follow when sewing so the rope will not twist. Start on the foot at the clew and work to the right. Use sail twine, doubled and waxed, in a sailmaker's needle, the end of which has been slightly blunted.

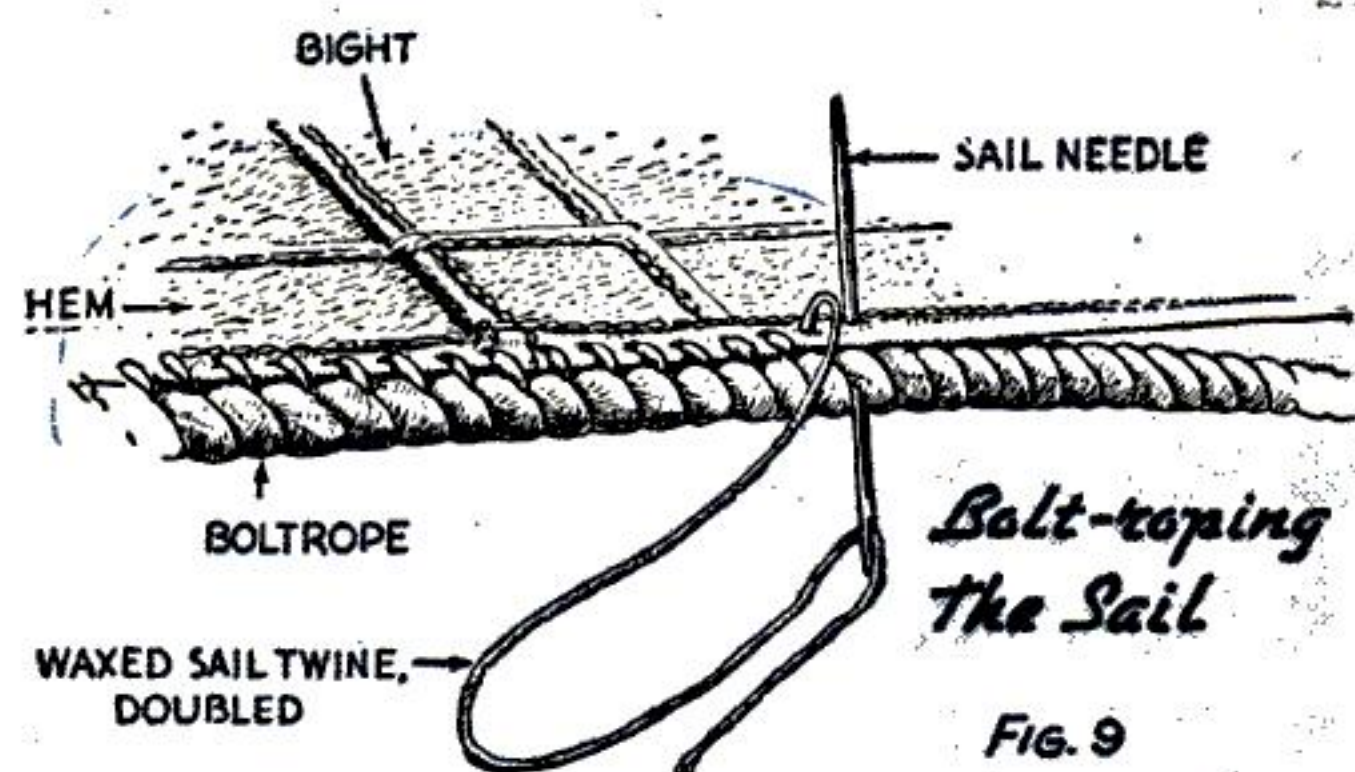
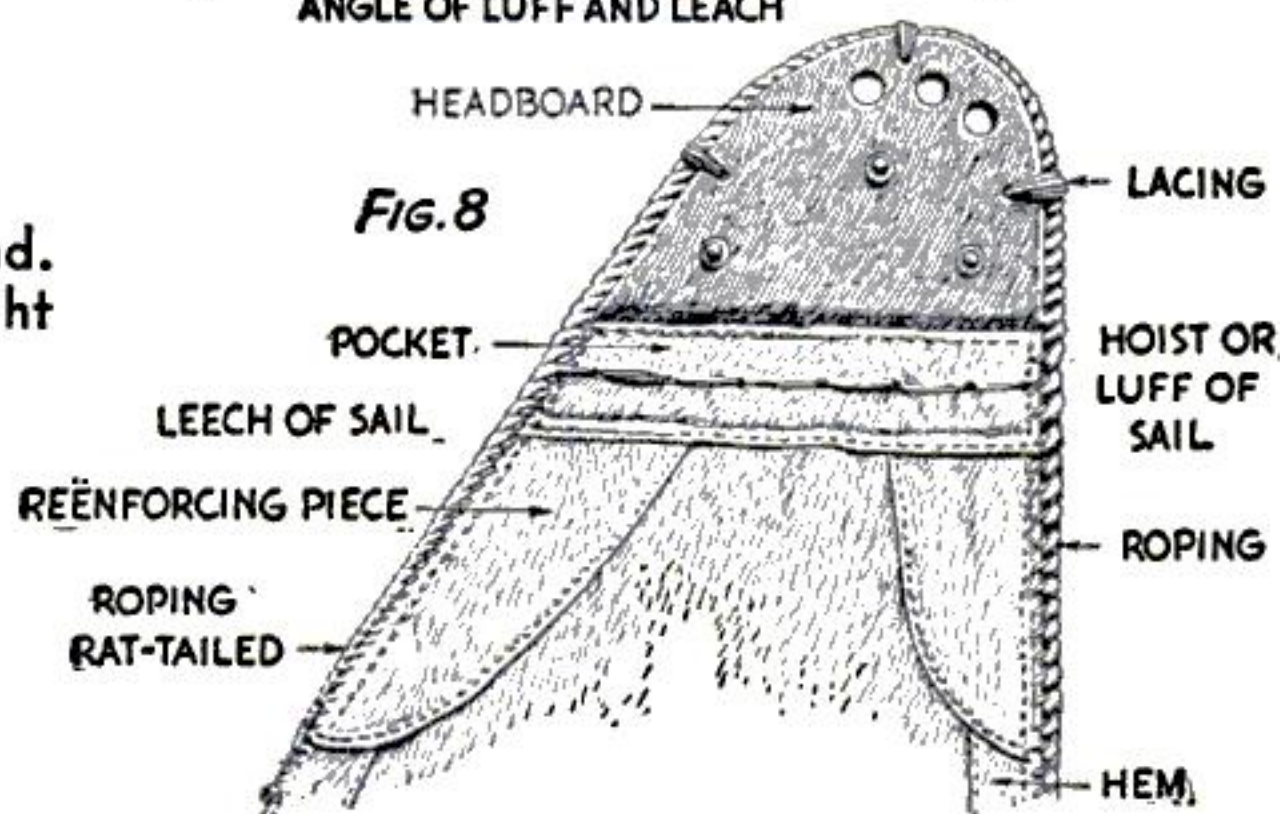
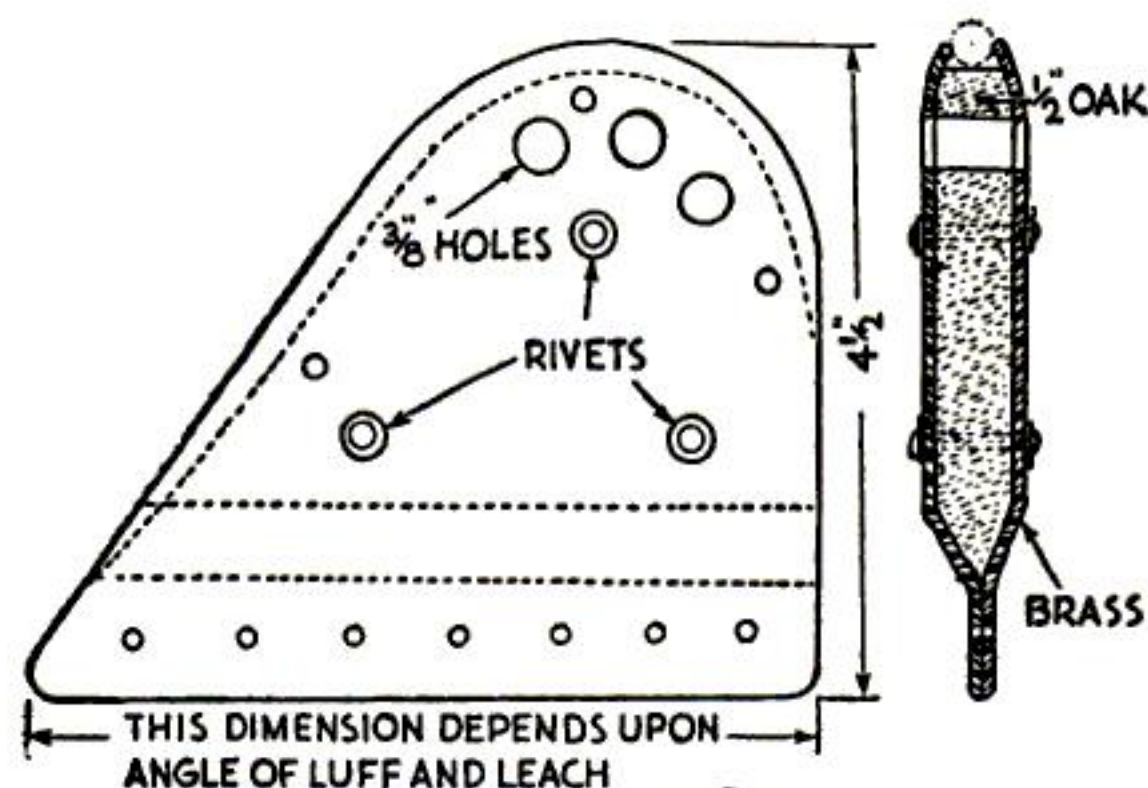
Fasten both sail and rope to something solid at either end to hold them in place while being worked on. Then, while holding the rope under the edge of the sail, put the needle under the upper strand of rope by pointing the needle a little to the left. The needle goes up through the edge of the sail about $\frac{1}{8}$ " in, then back over and up under the next strand of rope. Each stitch will sink in between the rope strands as shown in Fig. 9. A sailmaker's "palm" will make the work easier, but a block of hardwood held on the knee may be used to push the needle through. Finish off with another rat-tail on the leech after going over headboard. Then go back and sew in the opposite direction to the first rat-tail on the luff at the clew.

Small mainsails well under 100 square feet may not need reef points because such sails are usually taken in entirely if it blows too hard. However, if reef points are decided on, a detail will be found in Fig. 6. Reef points are set on a line parallel with the foot and about one fifth of the way from foot to head.

To hold out the roach of the leech, thin wooden battens are used. The details of the pockets in which these battens go will be seen in Fig. 6.

After the mast and boom track slides have been attached to the boltrope about a foot apart, your mainsail is ready for use. In setting it, do not haul it out tight on either mast or boom, but let it gradually stretch for you while sailing, otherwise you will get your sail out of shape.

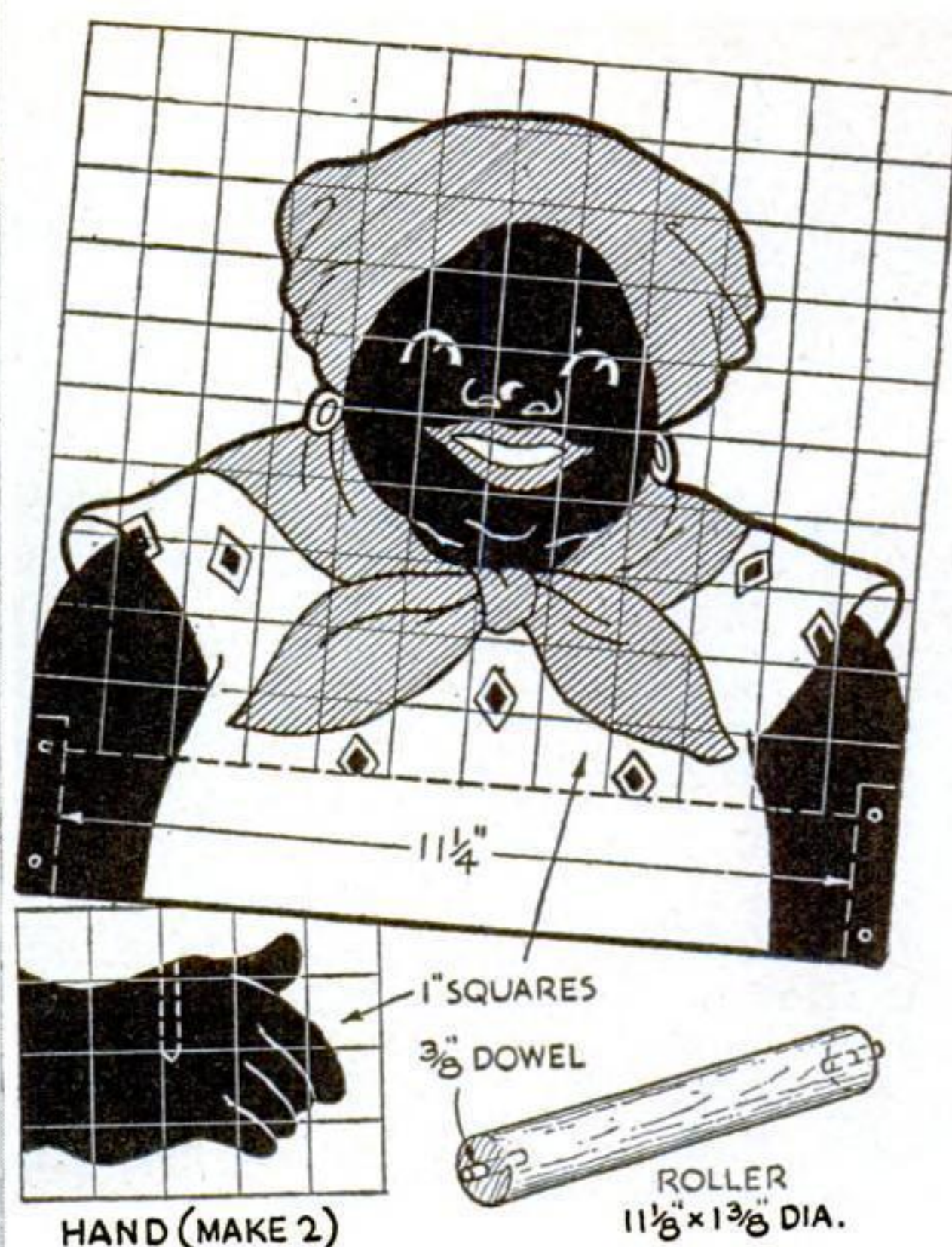
A jib is made similarly except that it has



A boltrope should be sewed on the port side with about half its diameter protruding beyond the edge

no headboard. The boltrope runs along the foot and longest edge of the sail. If the jib is to be loose-footed, that is, trimmed from the clew corner, the foot can be curved $\frac{1}{4}$ " to the foot. If a club is used, the foot is made straight. The snaps with which the jib is attached to the jib stay are fastened to the boltrope along the longest edge of the sail, and are spaced from 12" to 15" apart.

Points to watch when making a first set of sails are (1) that the new sail is cut small enough to allow for natural stretching on the spars; (2) that the paper pattern is kept smooth and the sail cut accurately along the lines of the pattern with even allowances for hems; (3) that bights and seams are of even width and neatly sewed (the professional stunt of varying the widths of bights and seams should not be attempted); (4) that the boltrope is sewed on evenly and without twisting, and that the relative tension of sail and rope is kept the same while the sewing is done. Finally, use good material and take plenty of time.



The head and shoulders of Aunt Chloe are cut from $\frac{3}{8}$ " plywood and the hands from $\frac{1}{2}$ " hardwood. Left, the finished holder

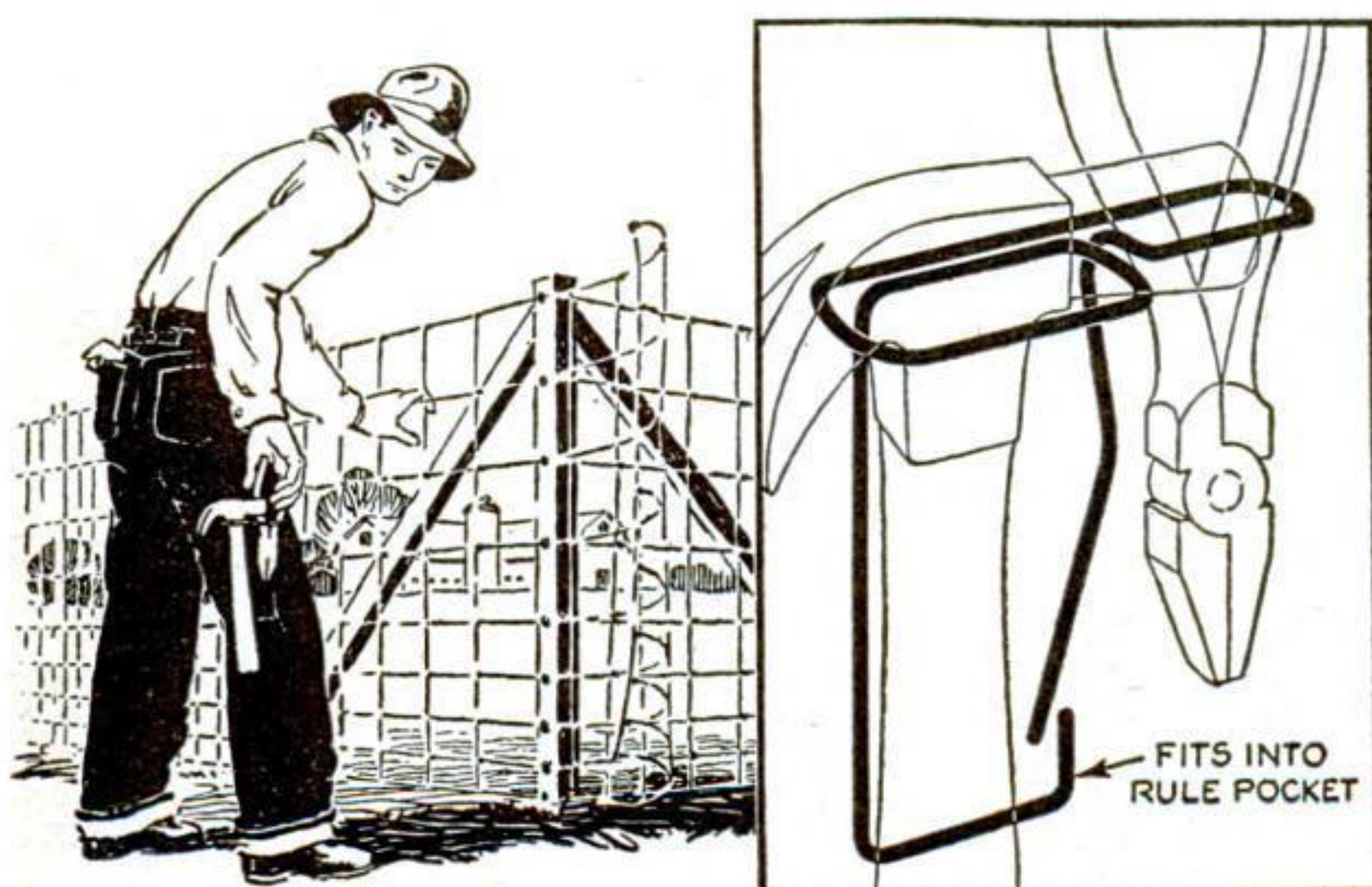
Gayly Painted Paper-Towel Roller

COLORFUL, up-to-date kitchens can be given an additional touch of gayety by making an Aunt Chloe holder for paper towels like that illustrated. It is intended for towels of the $7\frac{1}{2}$ " by 11" size.

Draw the face and upper part of the body on a smoothly sanded piece of $\frac{3}{8}$ " plywood and cut to shape. Make the two hands from $\frac{1}{2}$ " thick hardwood such as birch or maple. Cut a slot $\frac{1}{4}$ " deep and $\frac{1}{2}$ " wide inside each hand to hold the roller. Then prepare the roller, drill $\frac{3}{8}$ " holes 1" deep in the ends, and glue in pieces of $\frac{3}{8}$ " dowels $1\frac{1}{4}$ " long. Screw the hands on the backpiece with the slots

facing in, being sure that the roller will fit properly. It is well to use glue in the joints for added strength.

Color scheme: Face, arms, and hands, chocolate brown. Lips, red. Earrings and teeth, white. Eyes, white with black pupils. Head and neck bandana, light red and white with a square pattern. Dress, dark red with black diamond markings outlined with white. The blank space between the hands may be painted any plain color. Add a real bow of bright checked material, 4" long, in the center of the head bandana as shown in the photograph.—FRANK HEGEMEYER.

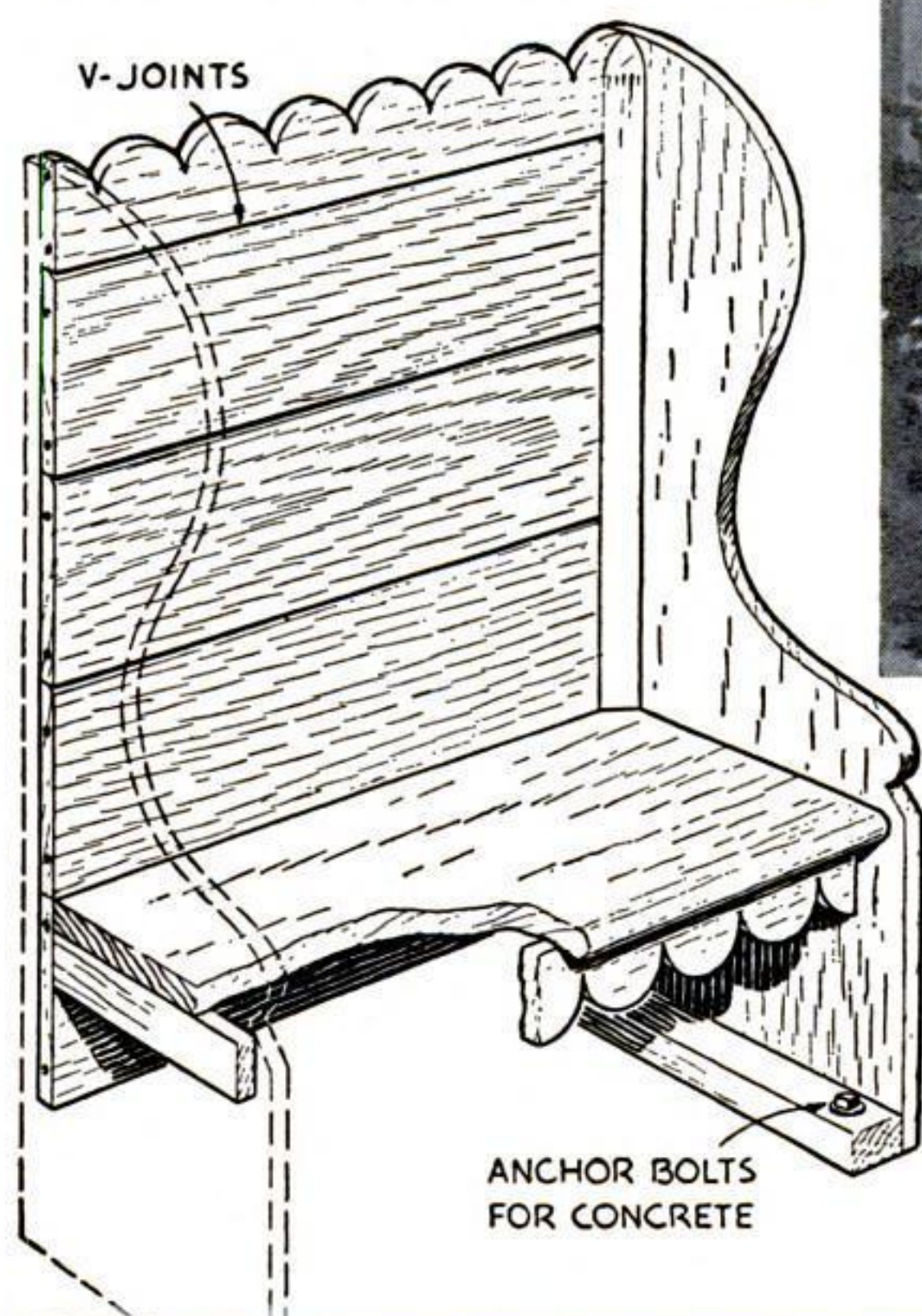


Fencing Tools Carried in a Wire Holder

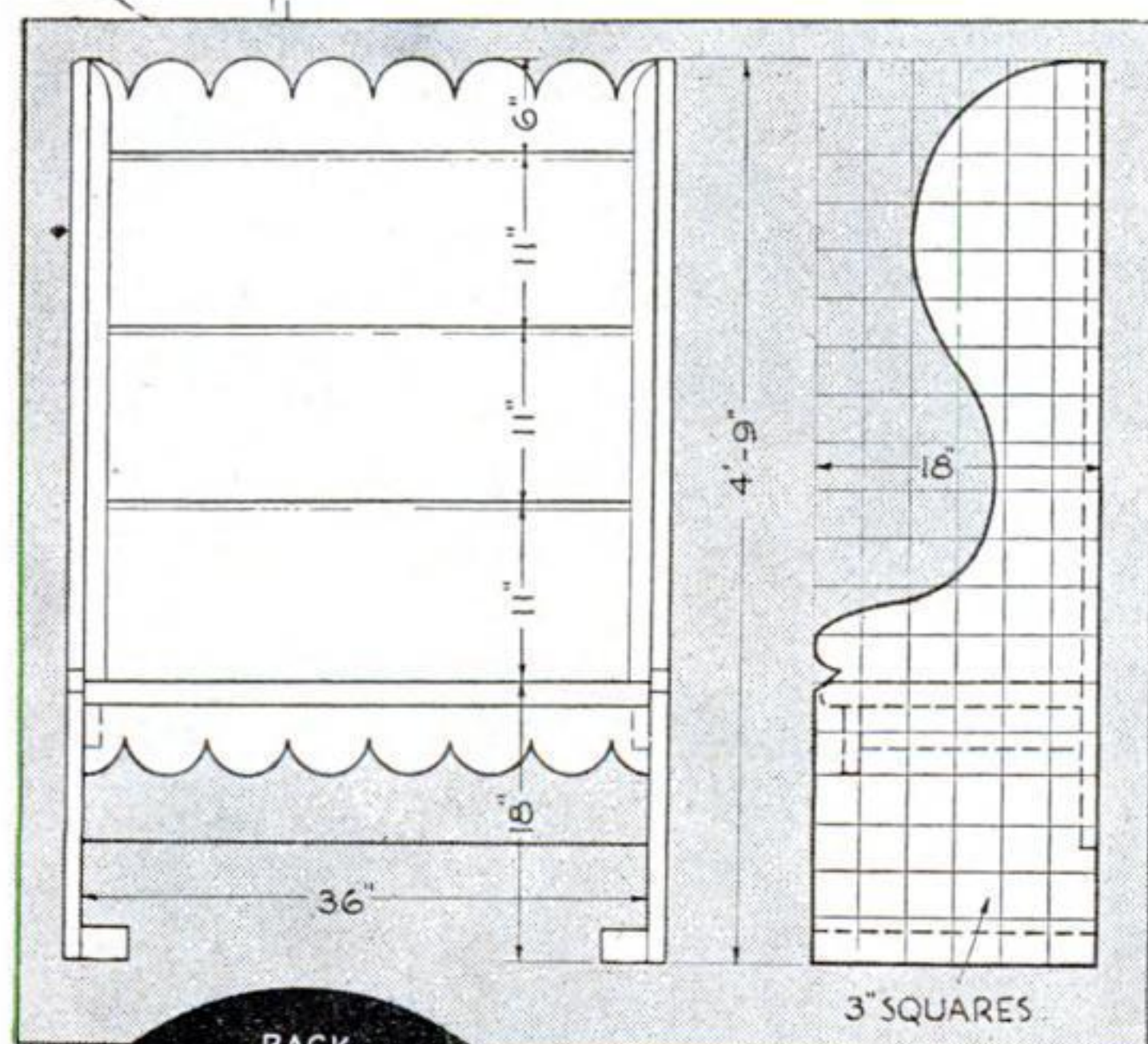
WHEN fences on the farm are to be repaired, much time is often wasted by stooping to pick up the necessary tools. The fencing pliers and hammer may be kept within easy reach simply by making a holder of heavy wire for them as shown. This is designed to slip into the rule pocket of the overalls, and is bent so the handle of the hammer slips through one loop and the nose of the pliers through the other.

DOOR-SIDE Settle

DRESSES UP THE
FRONT ENTRANCE



A NEAT-LOOKING settle beside the front door is not only a convenience to callers, but a pleasant place to sit in the sun or wait for the car to be brought around. Children in particular appreciate a seat of this kind where they can meet their friends and rest between games. White pine was used for the one illustrated. The sides, being 18" wide, were built up of two boards, casein-glued together. The back is of 11" boards with edges beveled to form a V-joint. Three-cornered battens are secured in the angles with finishing nails and casein glue, and dowels join the back and sides.—DICK HIXON.

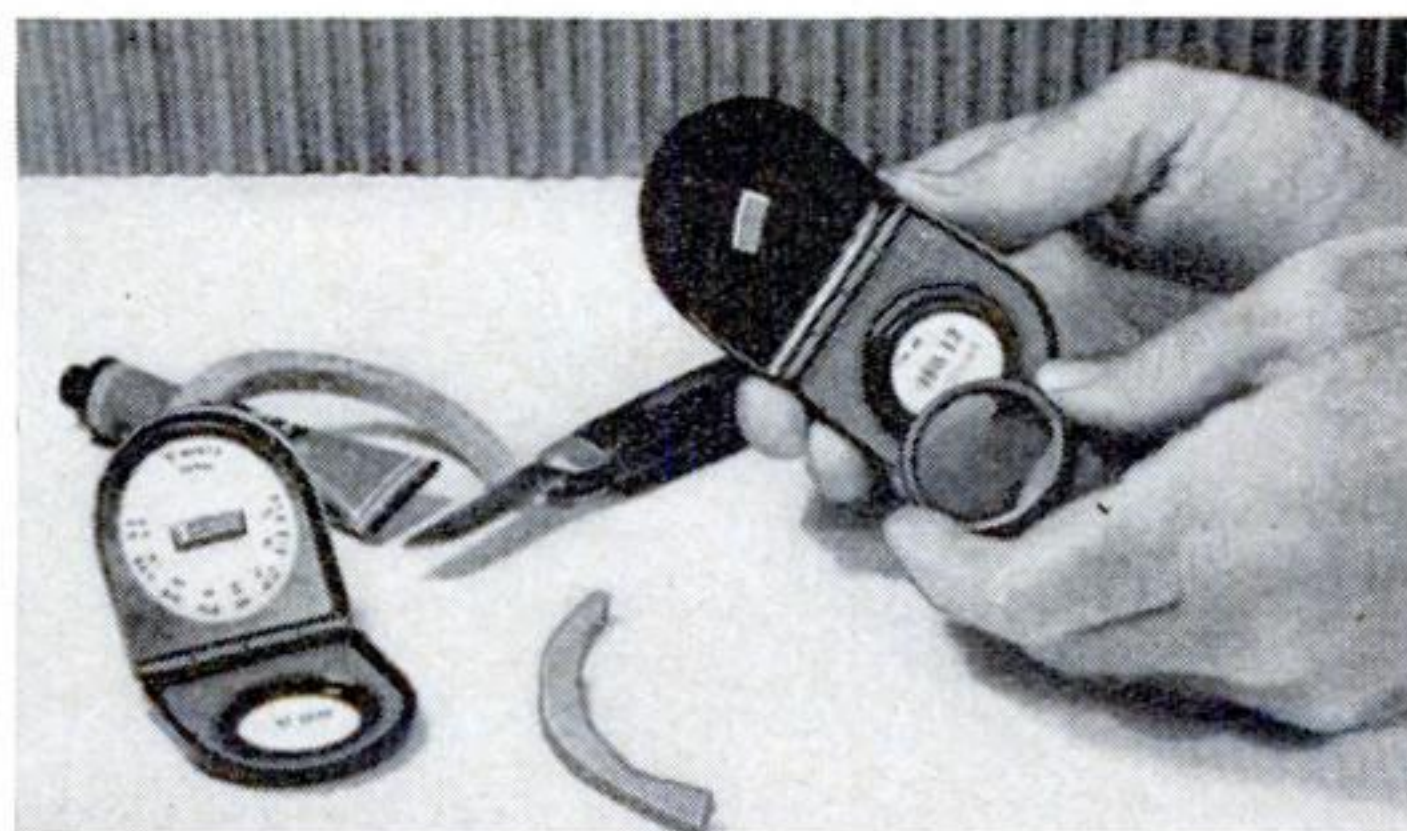


Front and side views with squares to aid in making a full-size layout of the sidepieces

Left, the simple type of reinforced joints used for the original settle

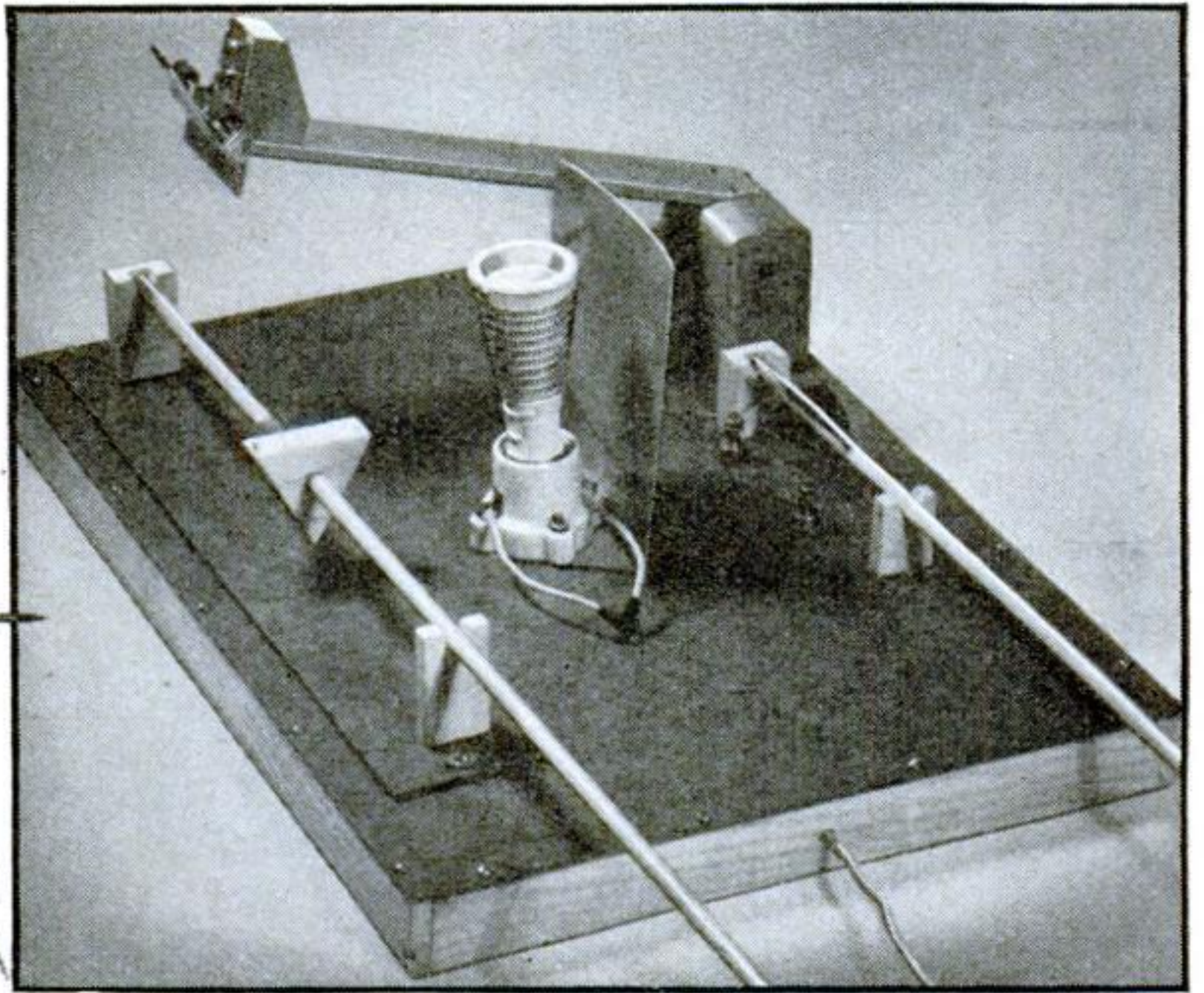
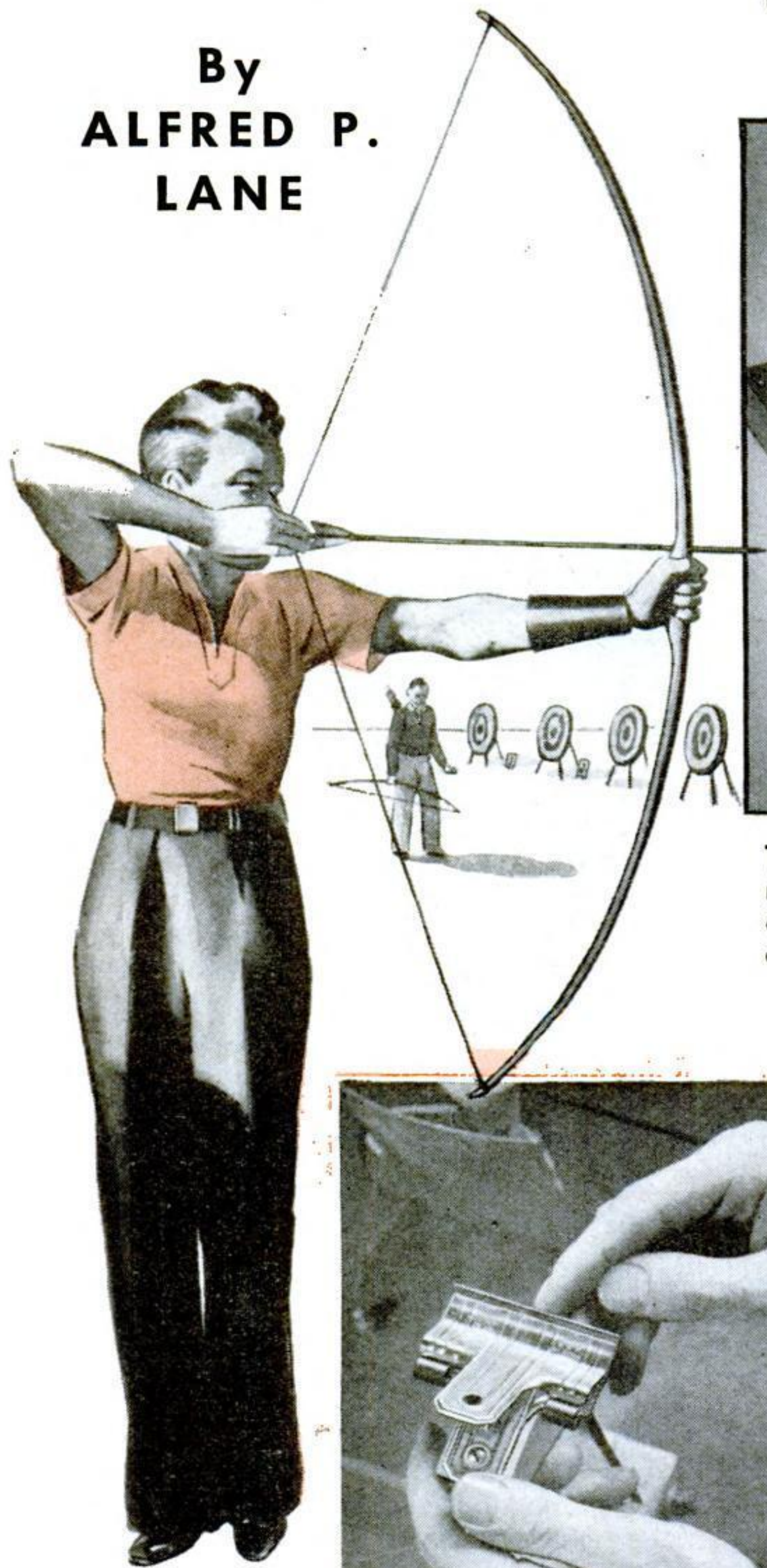
Sponge-Rubber Pads Keep Filters from Rattling

FILTERS and supplementary camera lenses may be held firmly in their boxes and the usual annoying jingle overcome by cementing a bit of sponge rubber into the top of the filter box. Small pieces cut from white sponge weather strip are ideal for this purpose.

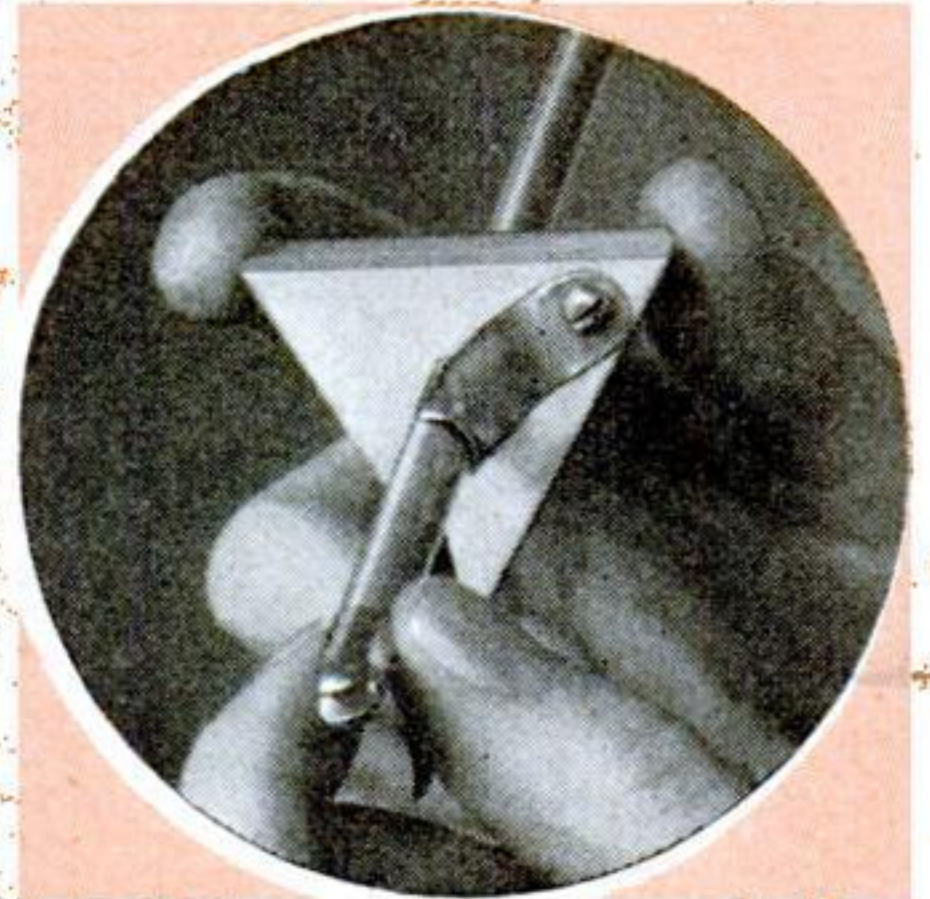
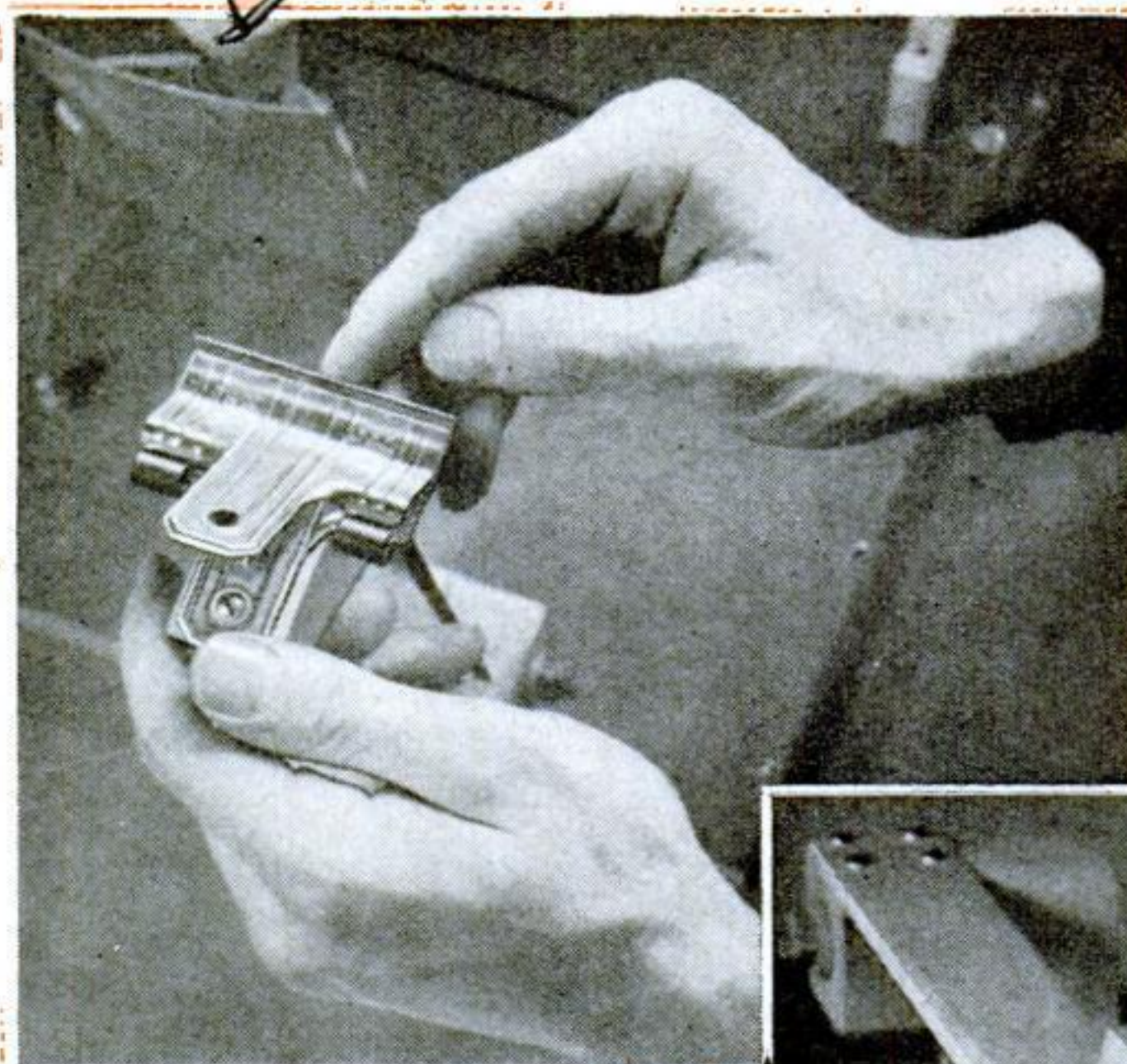


HOMEMADE Fletching Tool

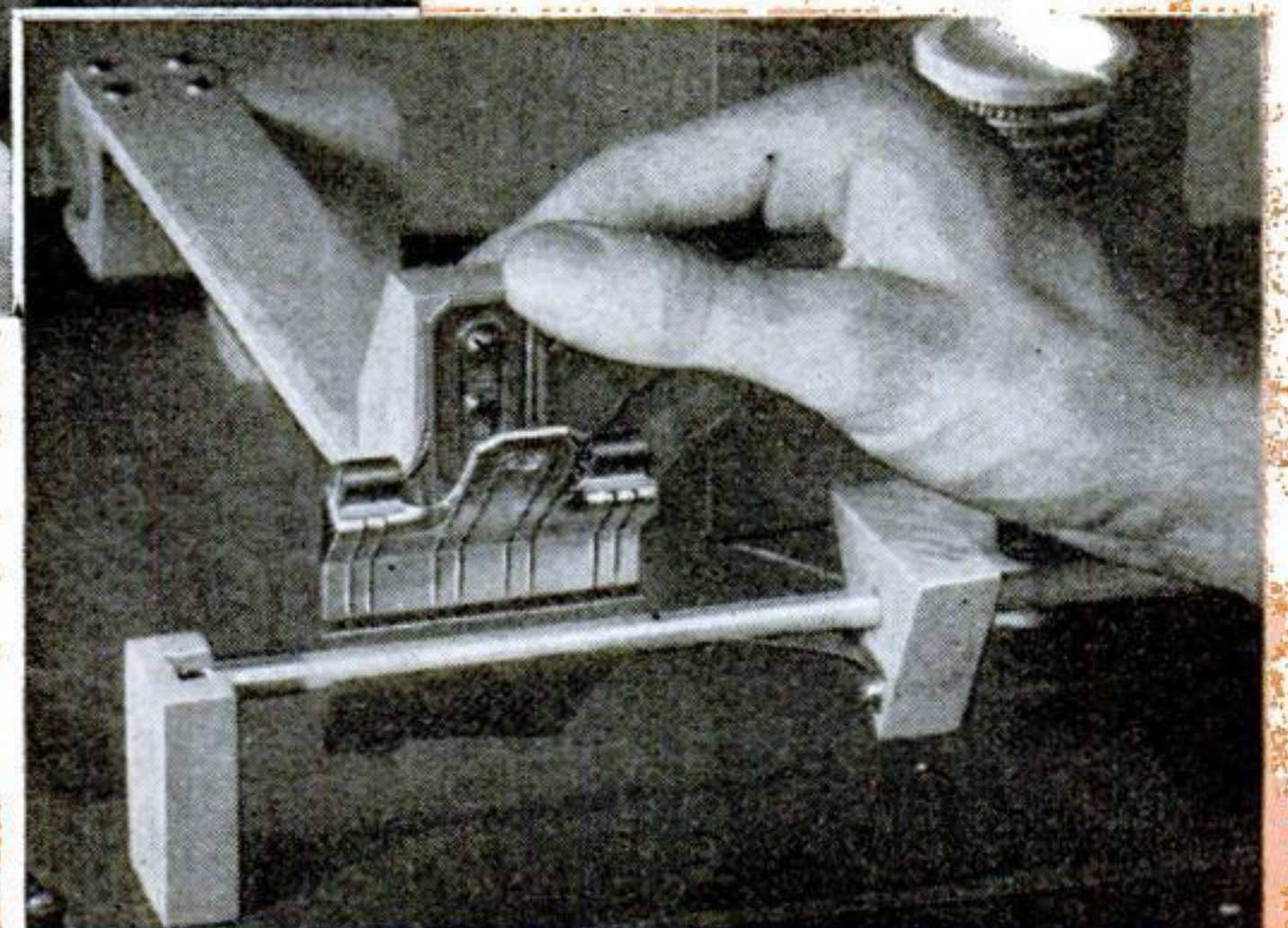
By
ALFRED P.
LANE



The base may be plywood or hard composition board mounted on a wooden rim. The V-blocks for feathering are set on a sub-base for easy adjustment. The paper clip on the end of the arm is bent to hold the feather



In circle, the three-sided spacing block has a spring to hold it on the shaft, and one flat side is kept in line with the nock. Above, the feather is clamped so about $\frac{1}{8}$ " projects. Right, testing the contact of a feather

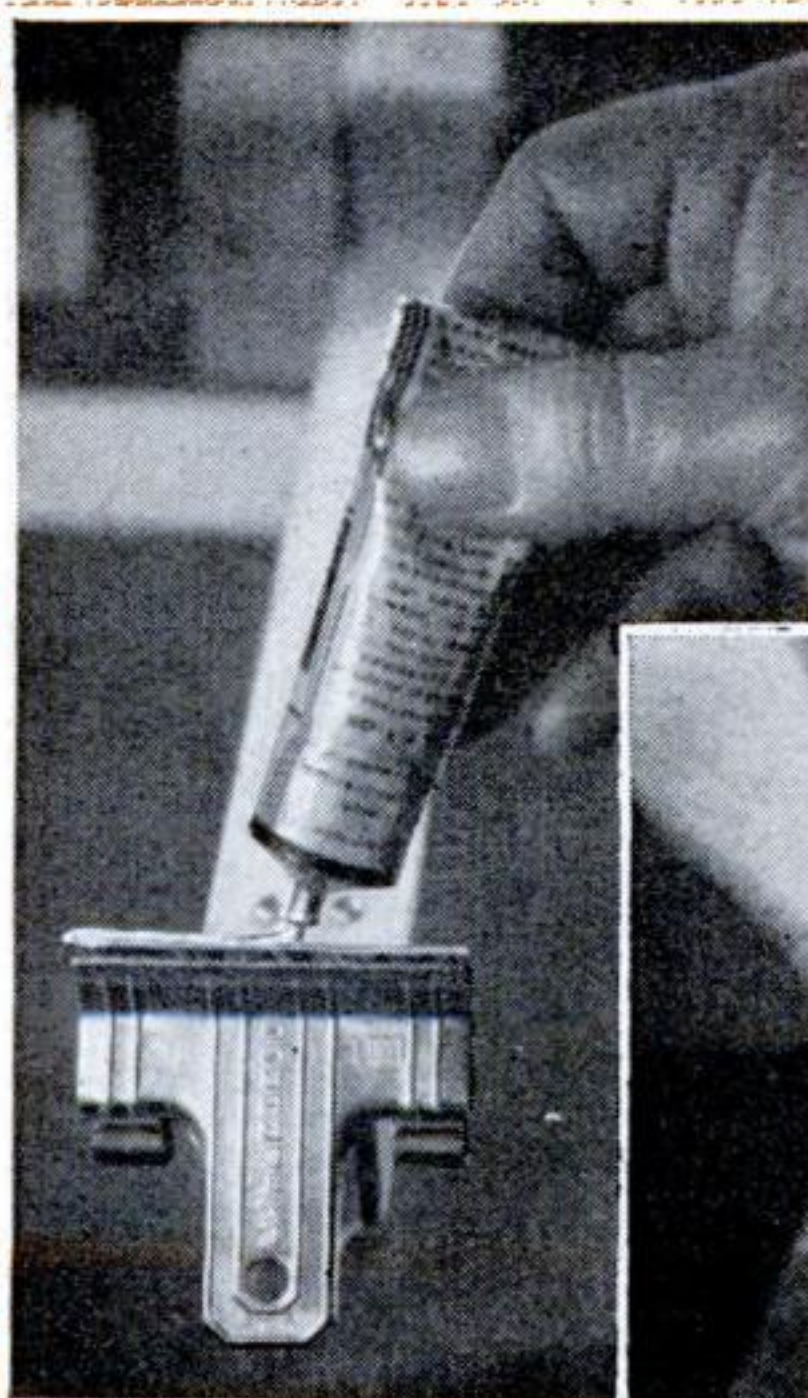
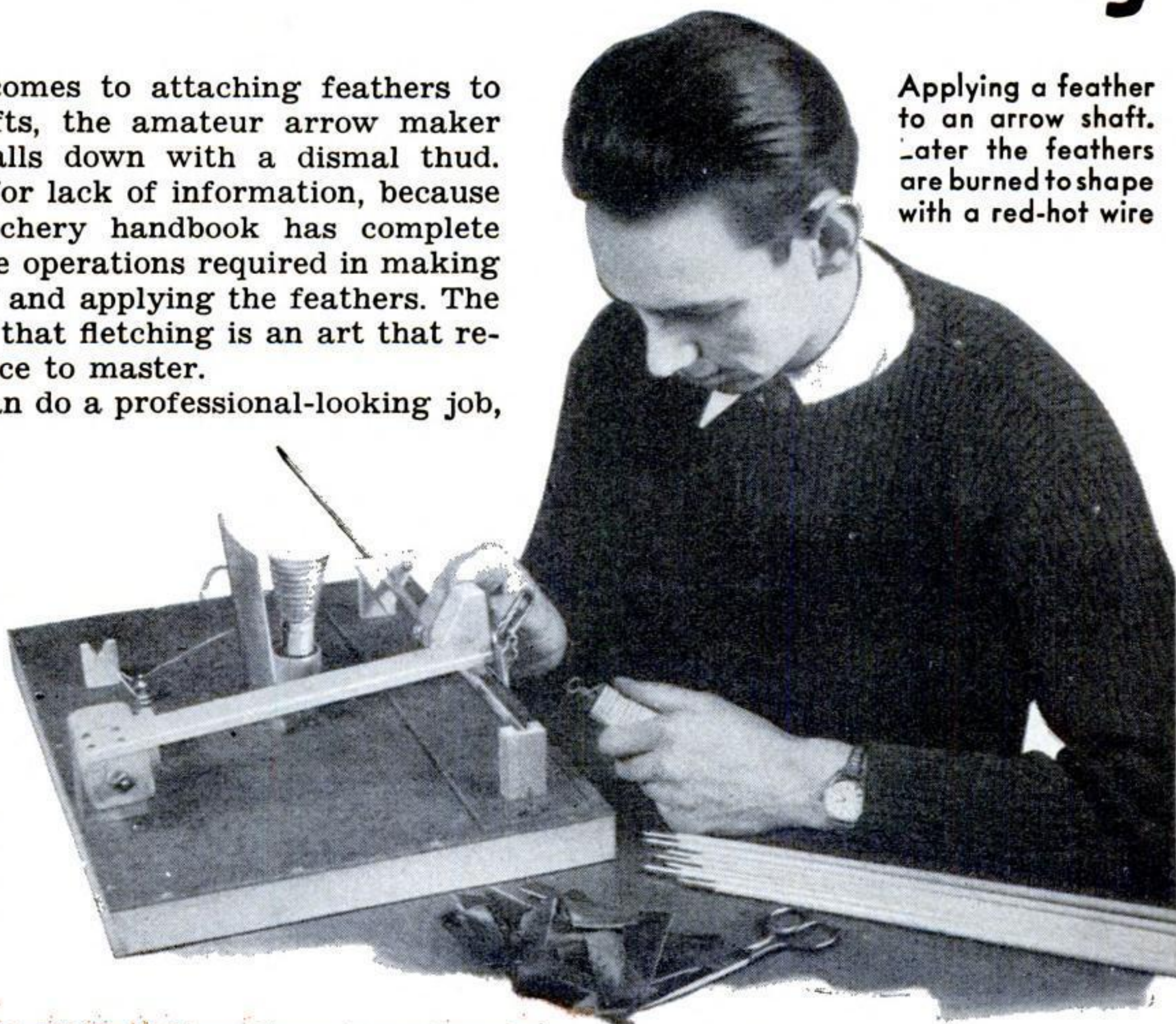


Feathers Arrows Perfectly

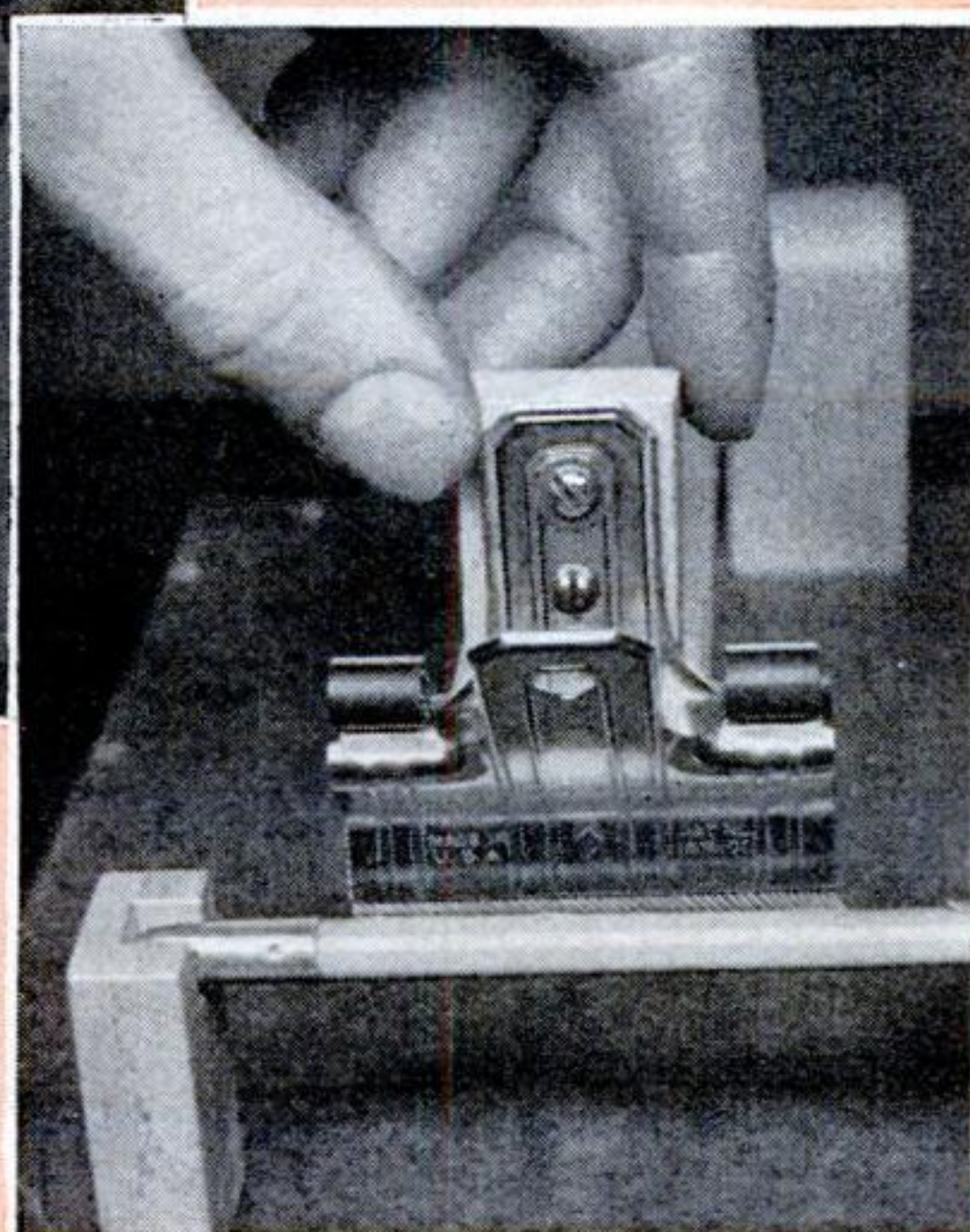
WHEN it comes to attaching feathers to their shafts, the amateur arrow maker usually falls down with a dismal thud. It is not for lack of information, because practically every archery handbook has complete instructions on all the operations required in making shafts and preparing and applying the feathers. The trouble is, of course, that fletching is an art that requires a lot of practice to master.

Even a beginner can do a professional-looking job, however, if he will build the simple mechanical fletcher illustrated. The cost of materials is low: ten cents for a 2" paper clip, about thirty-five cents for a standard heating unit of the type used in electric reflector heaters, and a little extra for such items as a porcelain lamp socket,

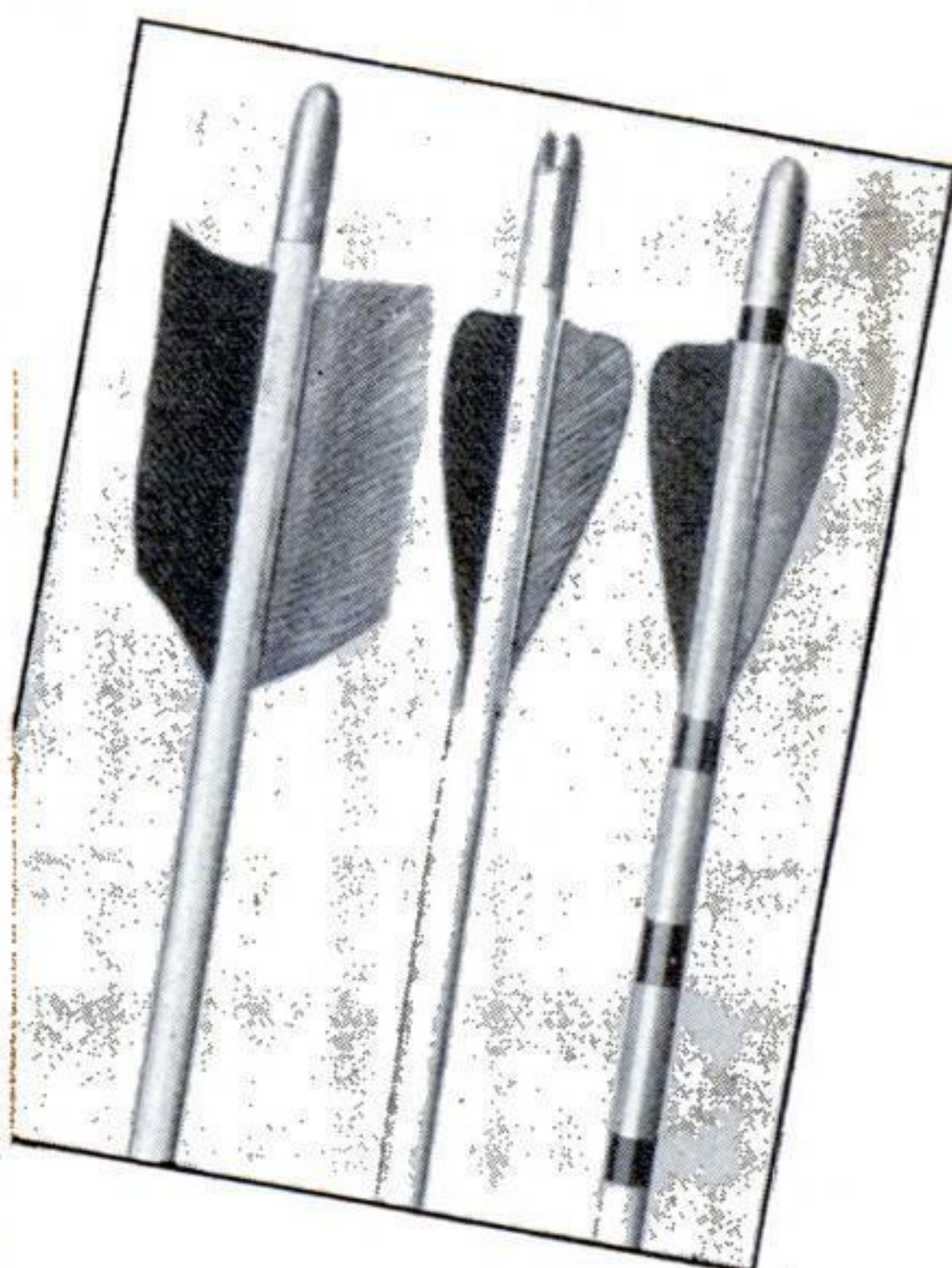
Applying a feather to an arrow shaft. Later the feathers are burned to shape with a red-hot wire



If the feather "fits" well along the shaft, the whole arm is swung clear over until the base of the feather is up. Then a fairly heavy "worm" of cement is squirted on, as illustrated at left



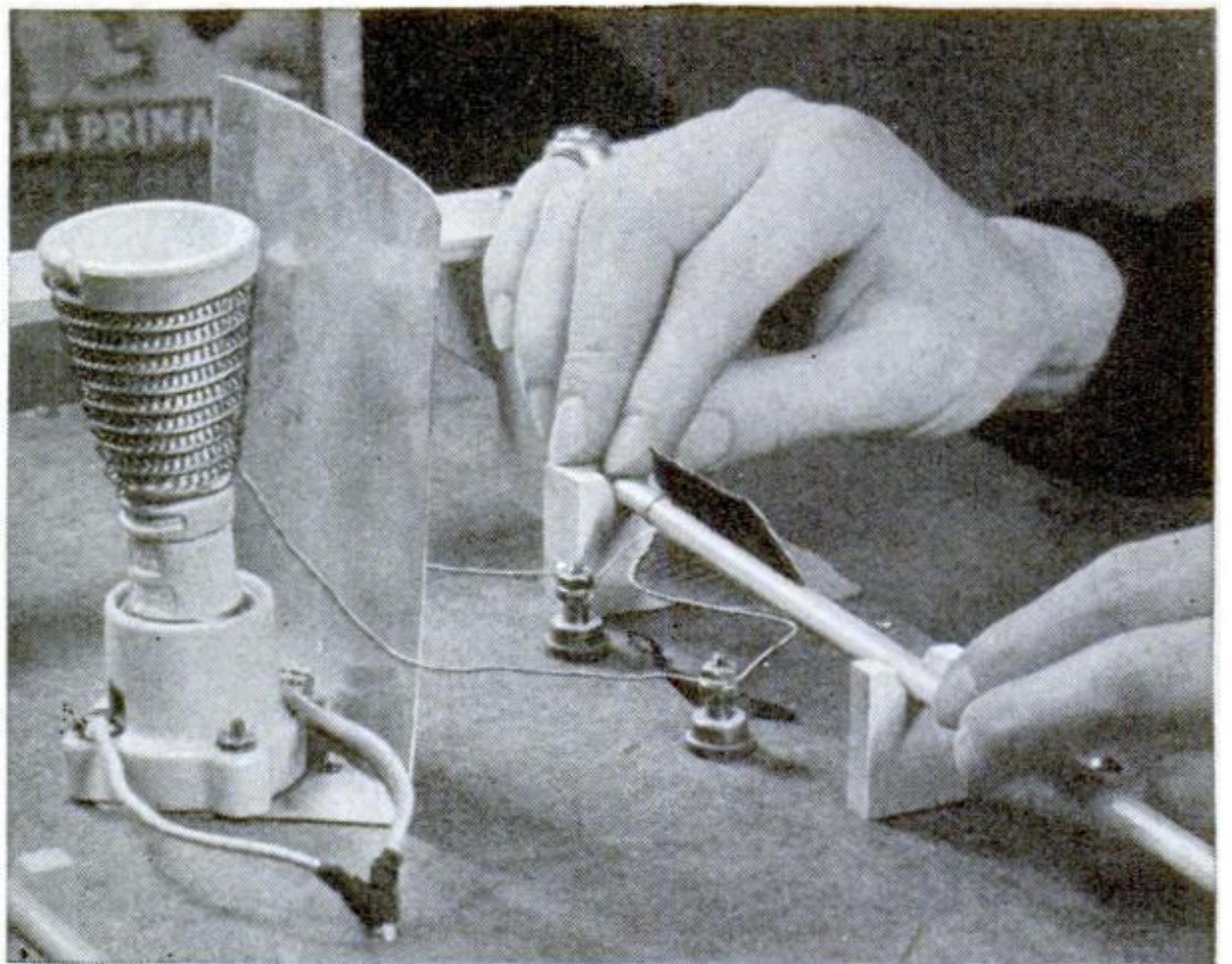
Right, the arm is immediately swung back to bring the feather in contact with the shaft and left undisturbed for half an hour



The feathers before and after being burned to shape, and the decorated shaft. Shave off the forward end of the base of each feather after the burning but before doing the crestring

As the arrow is rotated, the red-hot wire burns all three feathers to shape. Part of the heating-element wire is used for this, and it is mounted to clear the shaft at each end by 1/32"

Cresting is done with a 1/4" flat brush while the arrow is held in the feathering V-blocks



bolts and nuts, and a few odd pieces of lumber, although you probably have the latter around the workshop.

You don't have to have any fletching skill at all to apply feathers to arrows with this equipment. Careful attention to details will result in fletching that is mechanically almost perfect. Every feather will be put on perfectly straight and at precisely the same angle. You can't, of course, rush the work through as with certain types of multiple

fletching jigs, but this is of small importance compared to the greater accuracy and simplicity of the operation. And you don't actually lose any time in the long run. At intervals of not less than half hour, you can interrupt whatever else you are doing for a few minutes while you turn the arrow to the next position, put another feather in the clamp, squirt a "worm" of cellulose cement along its base, and seat it on the shaft. When you have the feathers cemented on a dozen arrows, it won't take you more than ten minutes to burn them all to shape.

This method of fletching works best with cut feathers, but it will do a surprisingly good job with stripped feathers, too—even when they are so dried up and twisted that they look like a bunch of corkscrews.

WATER STAINS

[PAINTING]

Standard water stains are mixed and applied as follows:

1. Weigh out 4 oz. of dry aniline stain powder. Moisten with hot water to make a smooth paste. (Use only distilled or rain water for water stains, as hard water causes a loss of color.)
2. Add the paste to 1/2 gal. hot water. Stir well, then add water to make 1 gal. Cool twenty-four hours.
3. The wood should be sponged, dried, and sanded with 4/0 garnet finishing paper. Then use a rubber-set, rubber-bound brush without a tin ferrule to apply the stain freely and evenly with the grain of the wood.
4. Reduce the standard solution with measured hot water to make any lighter stain required. Mark the dilution ratio on the label.
5. Make up stock solutions of 1 oz. each of black, red, and yellow in 1-qt. jars to use in shading new colors or shades. Keep a record of each mixture for future duplication.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Hooded Garden Lath House

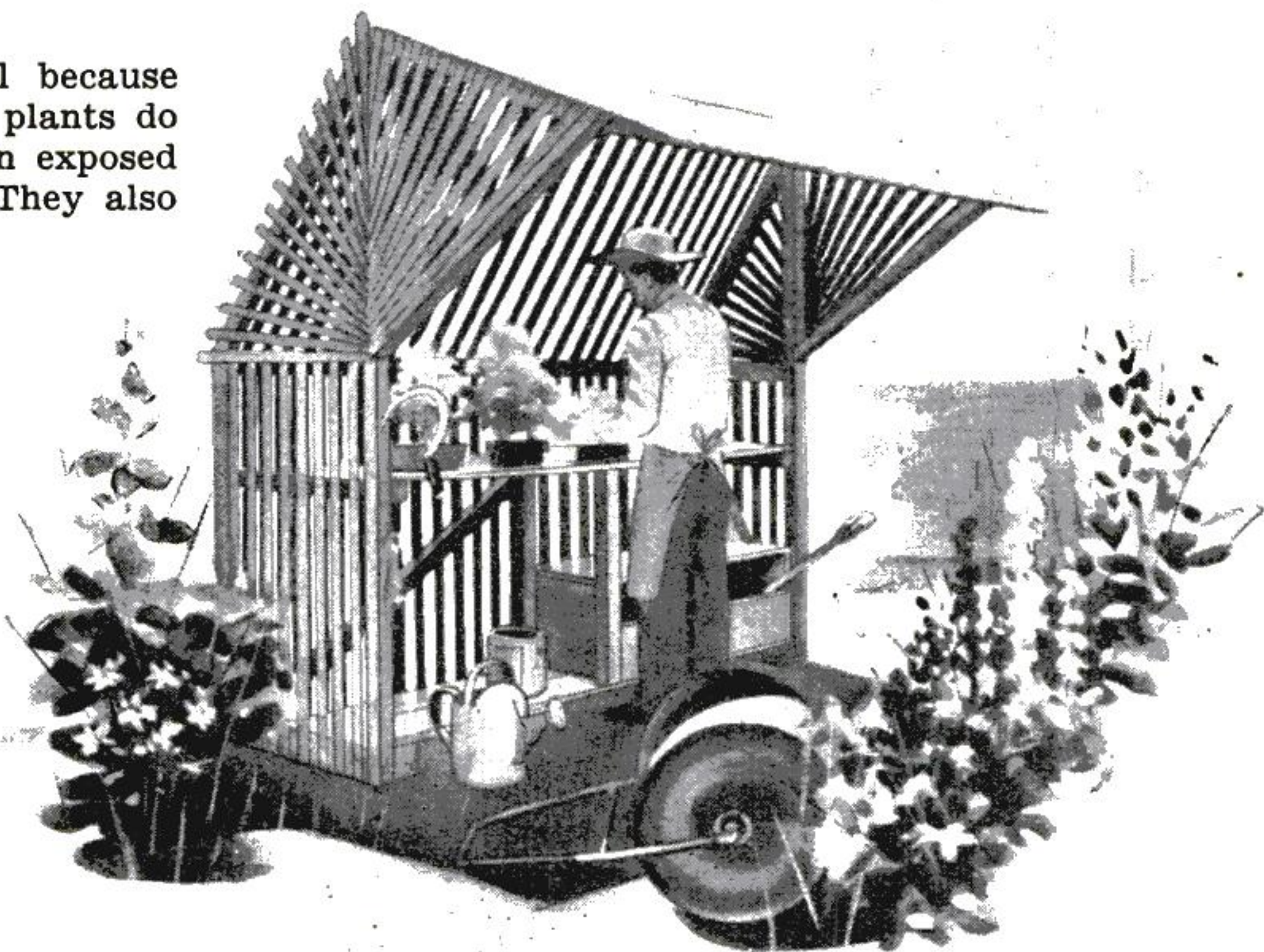
REQUIRES FEW MATERIALS

LATH houses are useful because seedlings and tender plants do better in them than when exposed to continuous sunlight. They also form a pleasant place to work.

An open, hooded lath house of the type illustrated has the advantage of requiring only about half the material of a fully inclosed structure of the same roof area, and at the same time it affords more room for the home gardener. It should be placed to face north. A potting bench should be installed at a convenient height for the gardener, and shelves can be added above the bench as required.

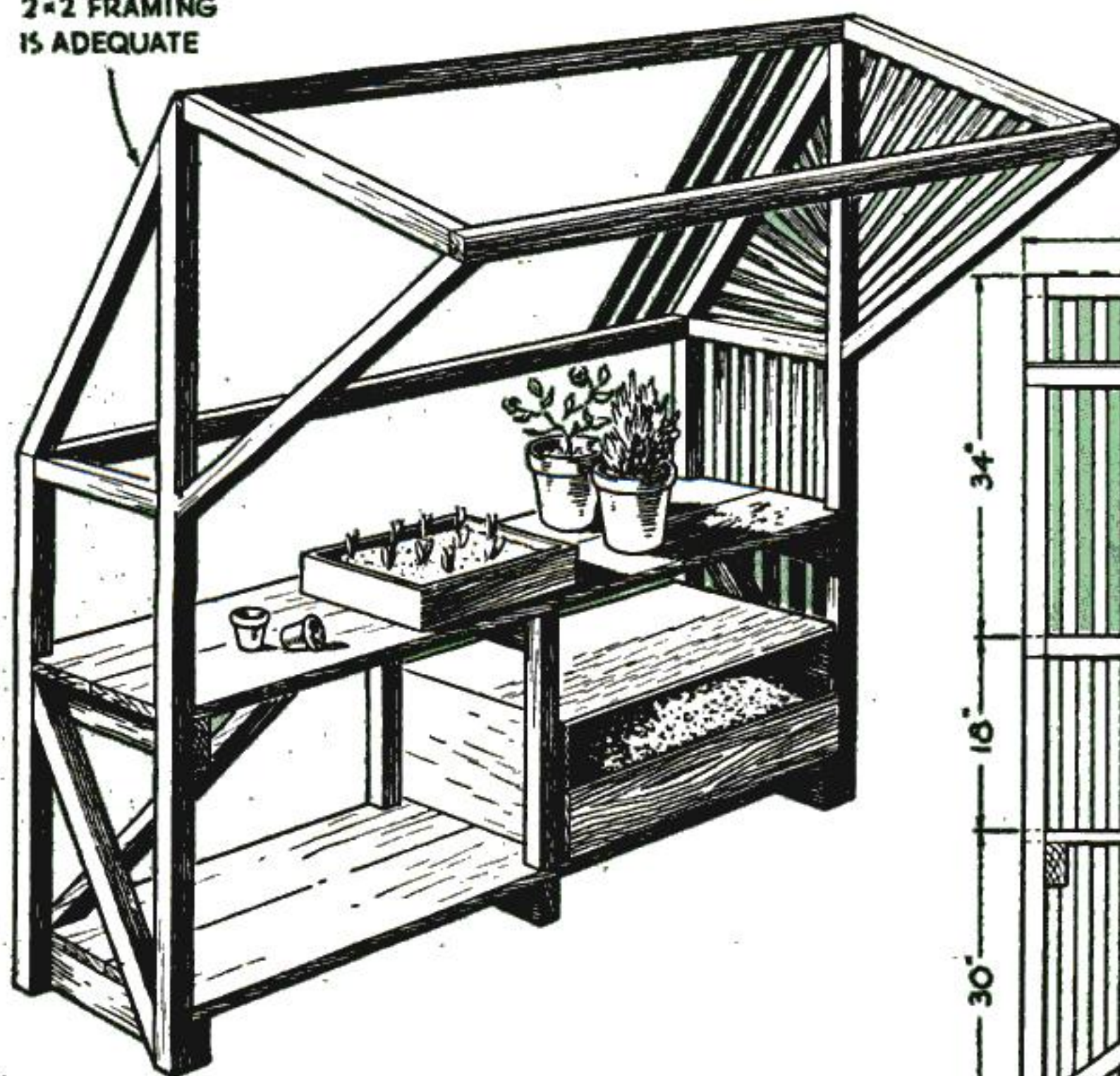
Being of light construction, this kind of lath house can be moved to other locations as the home garden expands. The side and end-

wall lath are laid vertically, and the roof lath from north to south. Thus each plant will receive an equal amount of light and shade.

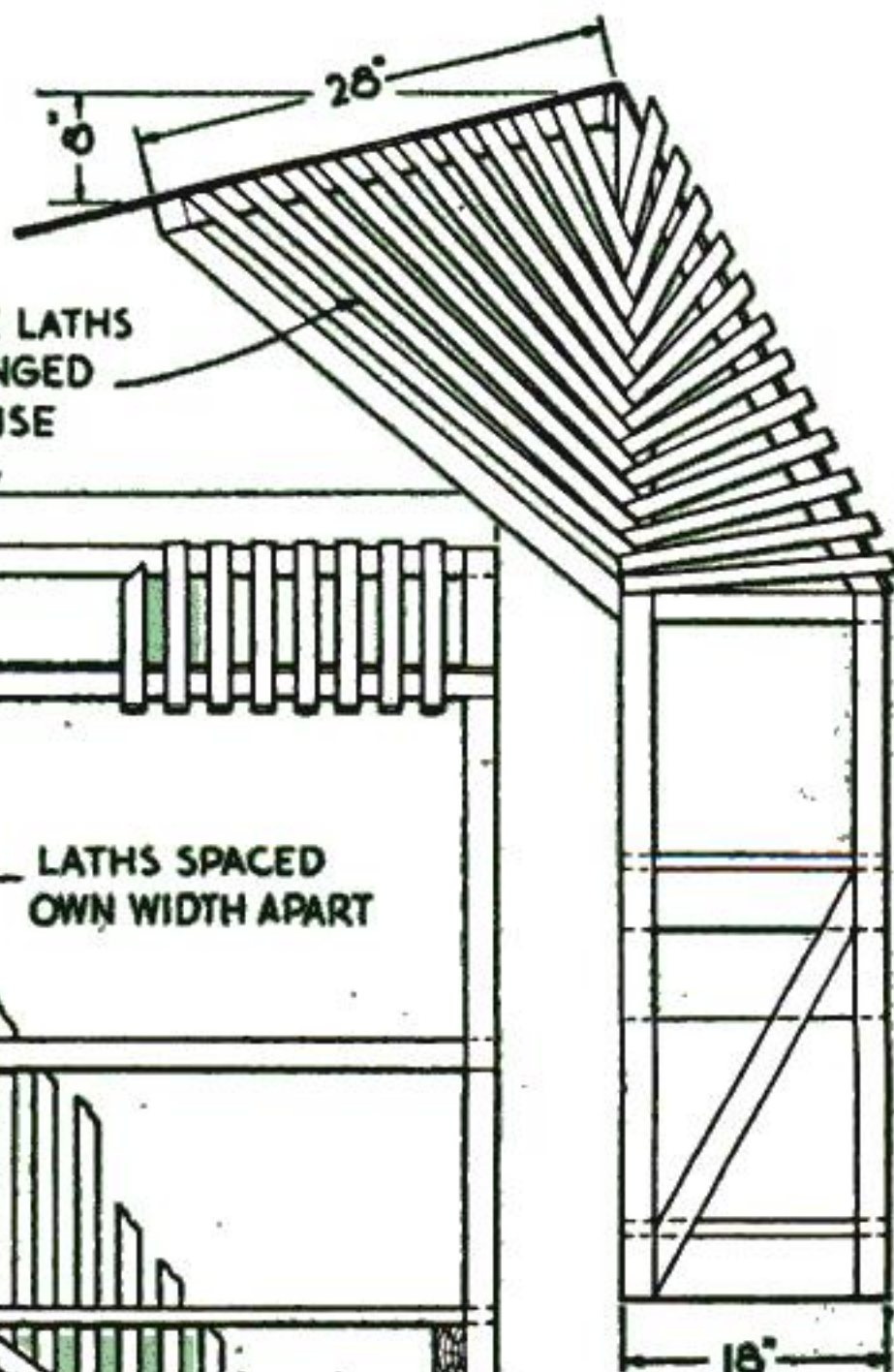


This lath house is of convenient size for a small garden, but could easily be made larger if desired

2"x2" FRAMING IS ADEQUATE

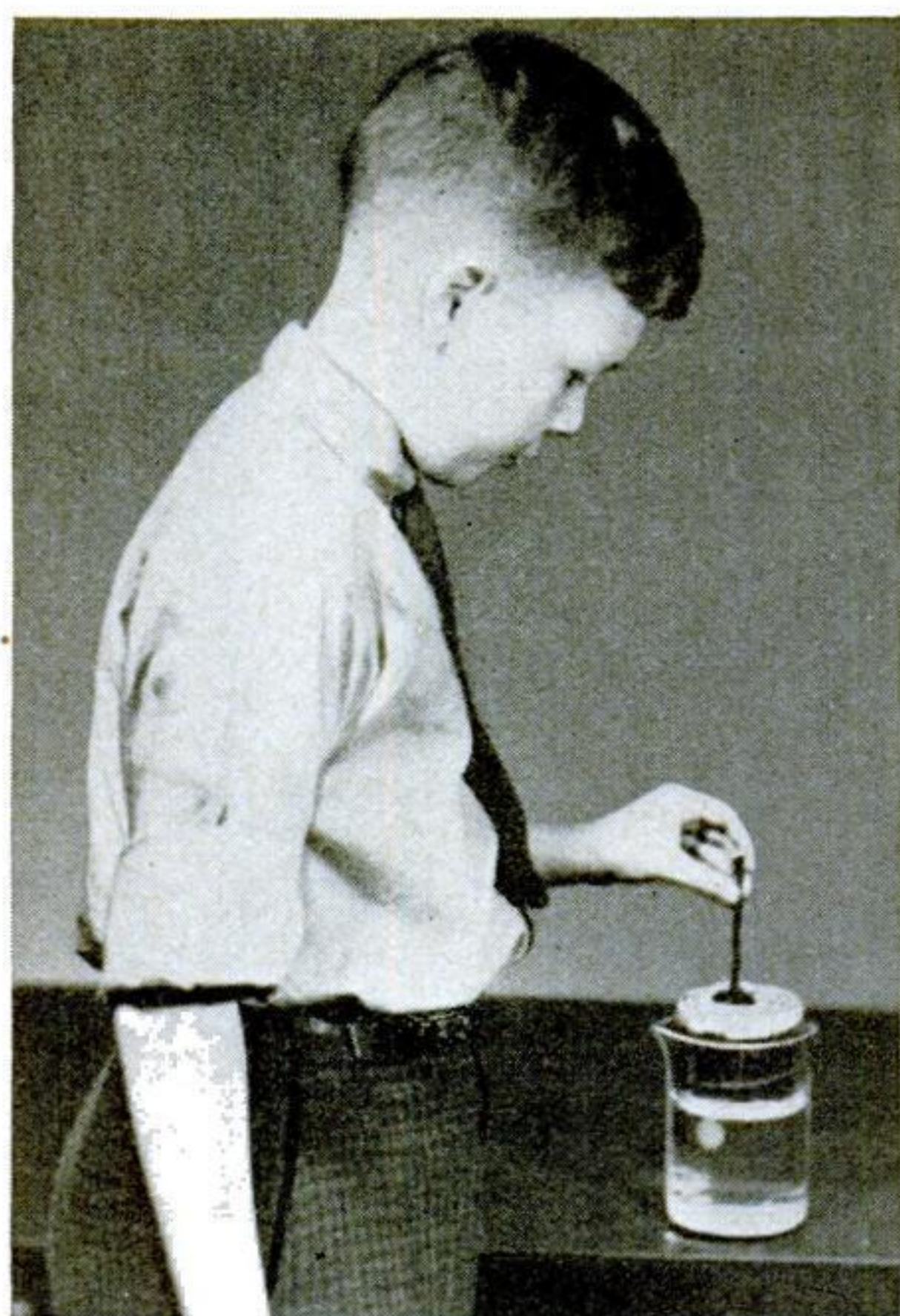


THESE LATHS ARRANGED FANWISE



LATHS SPACED OWN WIDTH APART

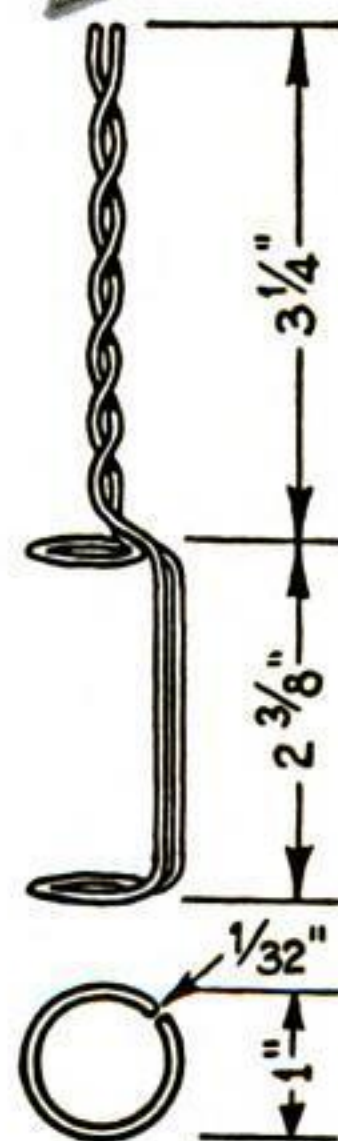
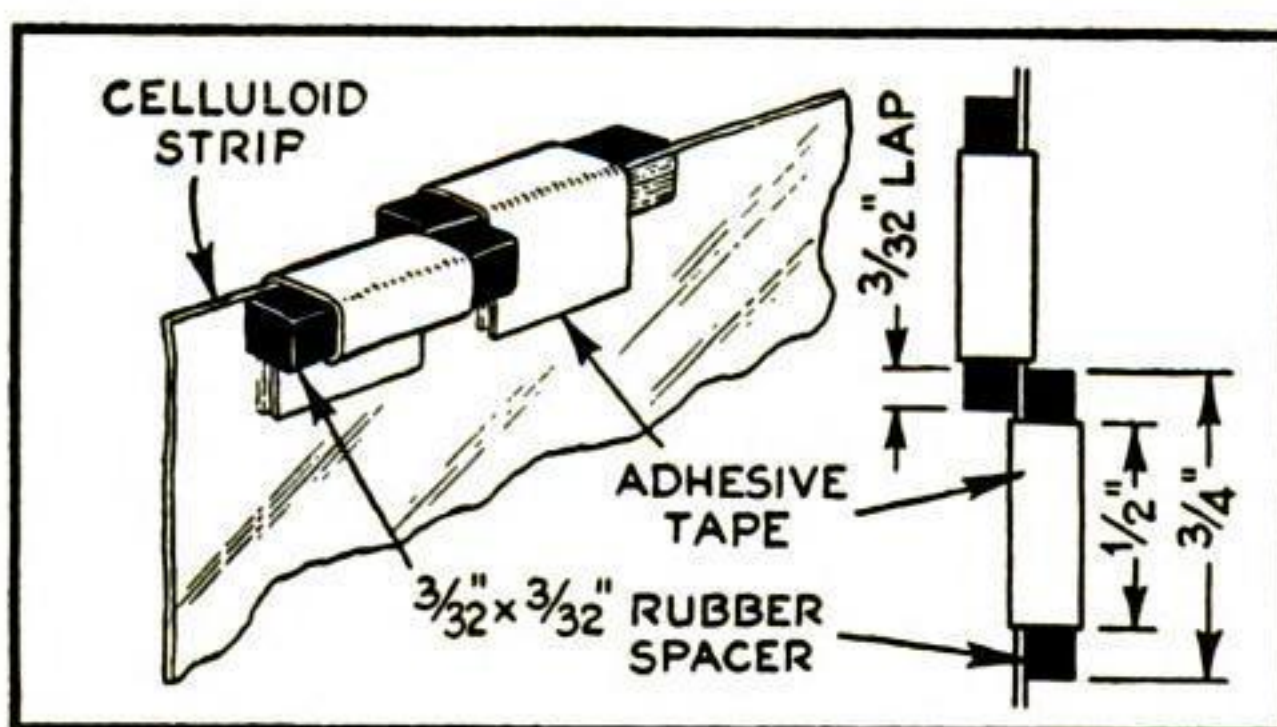
EARTH BIN



During development the reel is occasionally raised and lowered to agitate the solution



Removing film from ribbon after it has been developed, fixed, and washed. Note rubber spacers



Celluloid Ribbon and Wire Reel Take Place of a Tank for Developing Roll Films

FOR developing roll films easily and without danger of scratches, an efficient developing reel and ribbon may be made as illustrated. The dimensions are suitable for No. 120 film, but may be changed to fit other sizes.

A strip $2\frac{3}{8}$ " by 50" is cut from sheet celluloid, obtainable at an auto supply store. A number of rubber spacers $\frac{3}{32}$ " by $\frac{3}{32}$ " by $\frac{3}{4}$ " are then cut from a discarded automobile inner tube. Beginning 1" from one end, these spacers are bound on the edges of the celluloid for a distance of 40" with $\frac{1}{2}$ " by $\frac{3}{4}$ " pieces of waterproof adhesive tape. The ends of alternate spacers on opposite sides of the celluloid strip are arranged to overlap slightly so that the film is held free from wrinkles during treatment.

To form the reel, a length of No. 16 tinned iron wire, previously covered with radio spaghetti insulation, is bent to the dimensions given. Coating the exposed wire with celluloid cement and the whole surface of the spaghetti with model airplane dope effectively waterproofs this part.

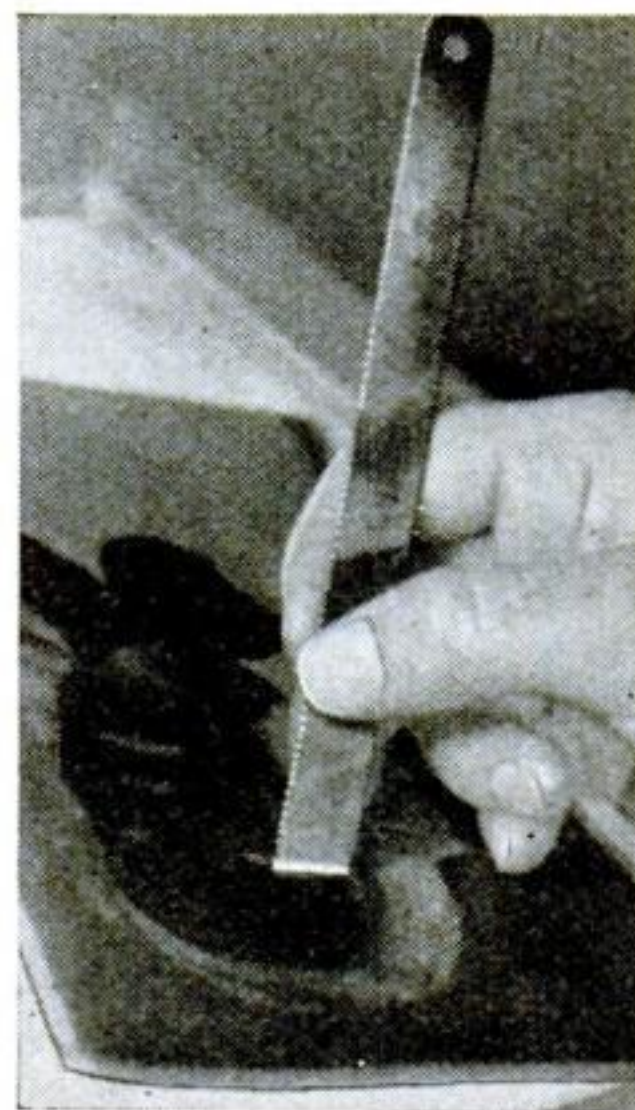
The end of the exposed film is attached to the inner end of the developing ribbon with a short piece of adhesive tape and the two are slipped into the slot in the reel. Film and ribbon are held by the edges only and

wound into a tight spiral. They are kept from unwinding by a rubber band. With a little practice, this operation can readily be performed in total darkness, as when handling panchromatic film.

The assembled unit is immersed in the required photographic solutions, which may be conveniently contained in 600-cc. glass beakers. Although undeveloped spots result from the contact of the emulsion with the spacers, these areas are very narrow.—AMOS SCOTT.

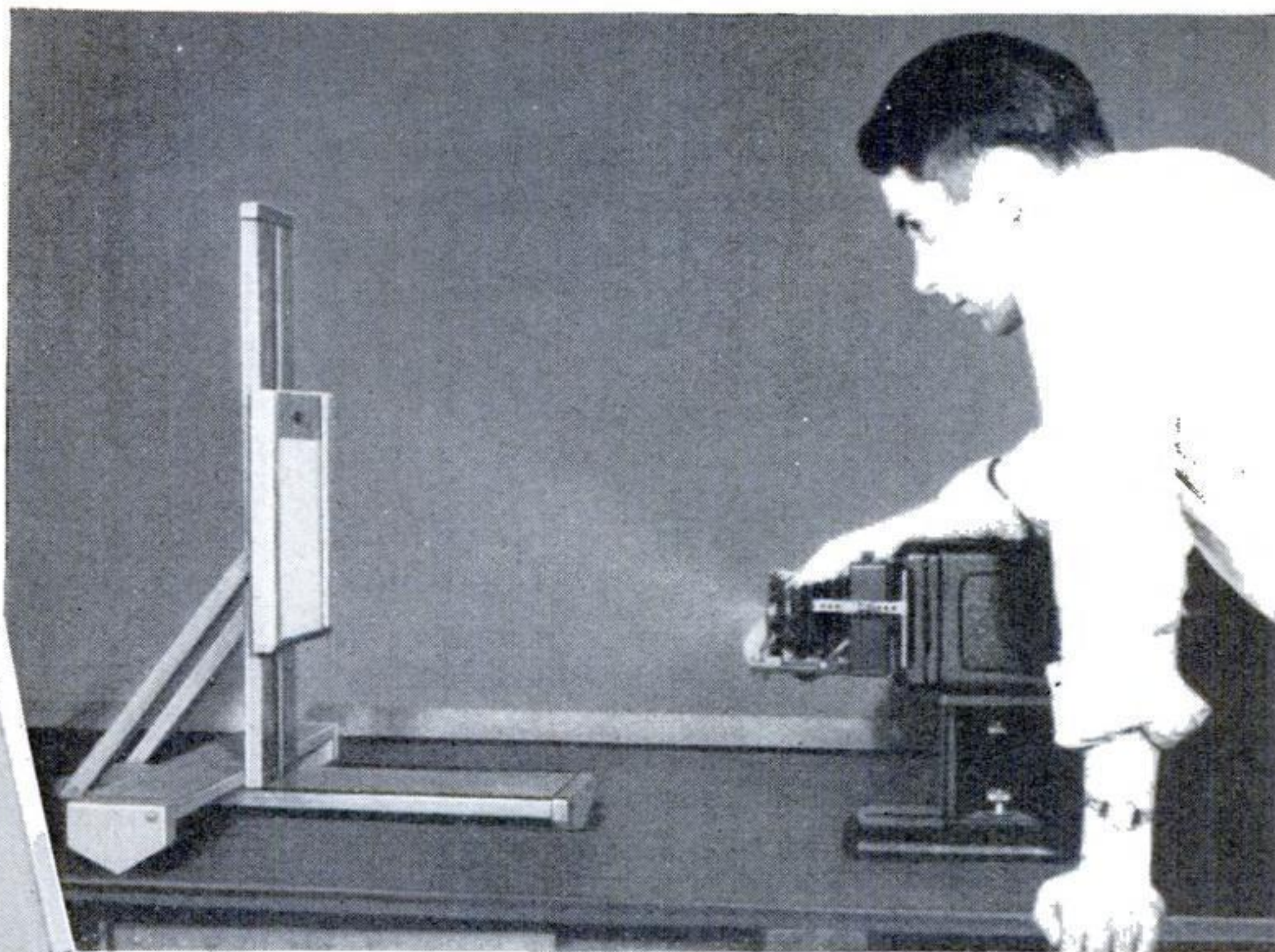
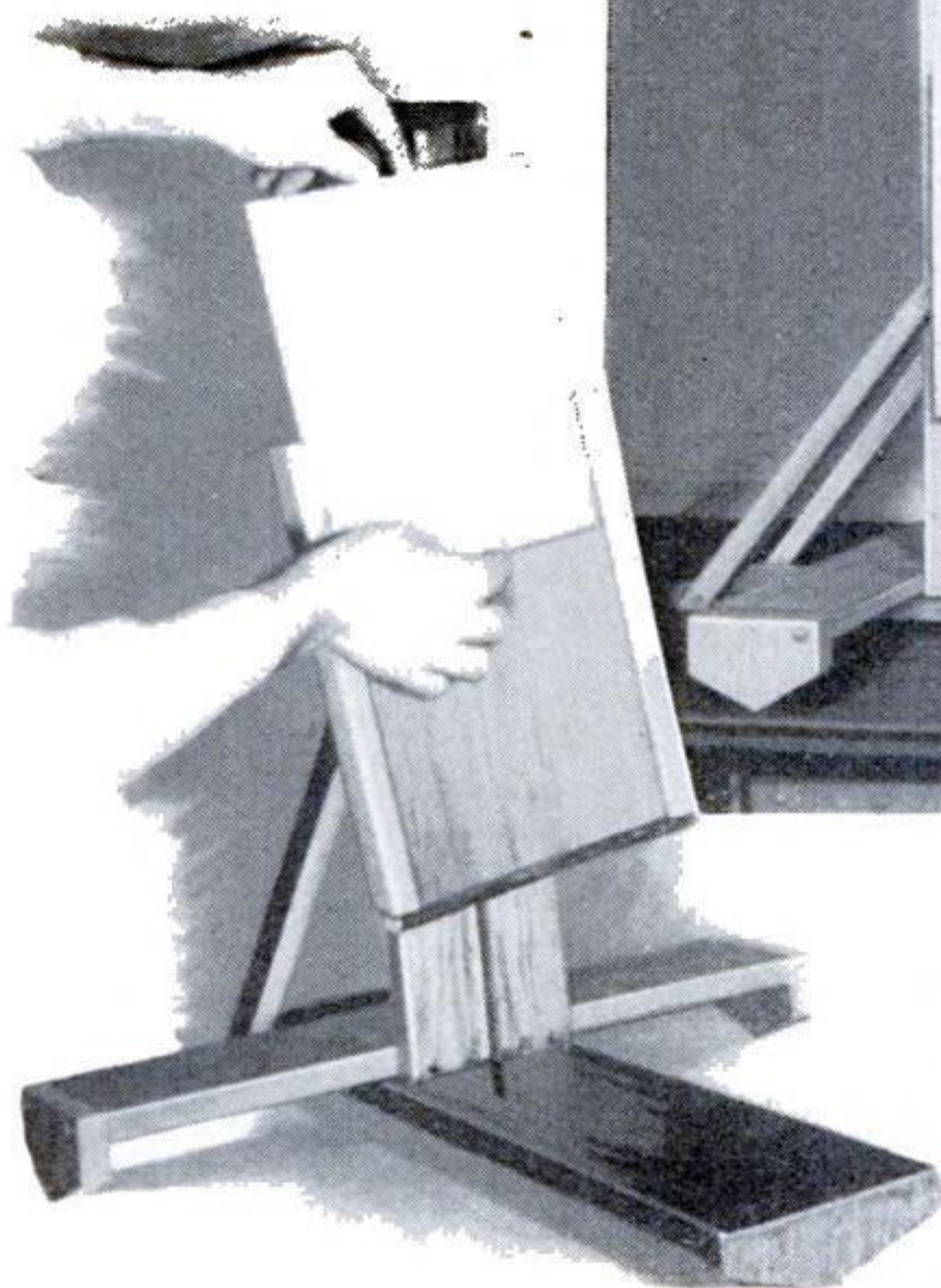
Etching Knife for Photos

IF THE end of an old hack-saw blade is ground at an angle of 10 deg., then beveled on one side and oil-stoned very sharp, it makes an excellent etching knife for scraping the emulsion off photo negatives that have to be re-touched.—F. T. C.



An Easily Adjusted Enlarging Easel

Vertical easel with three-point support and a paper holder that is raised or lowered and tilted to the right or left as required



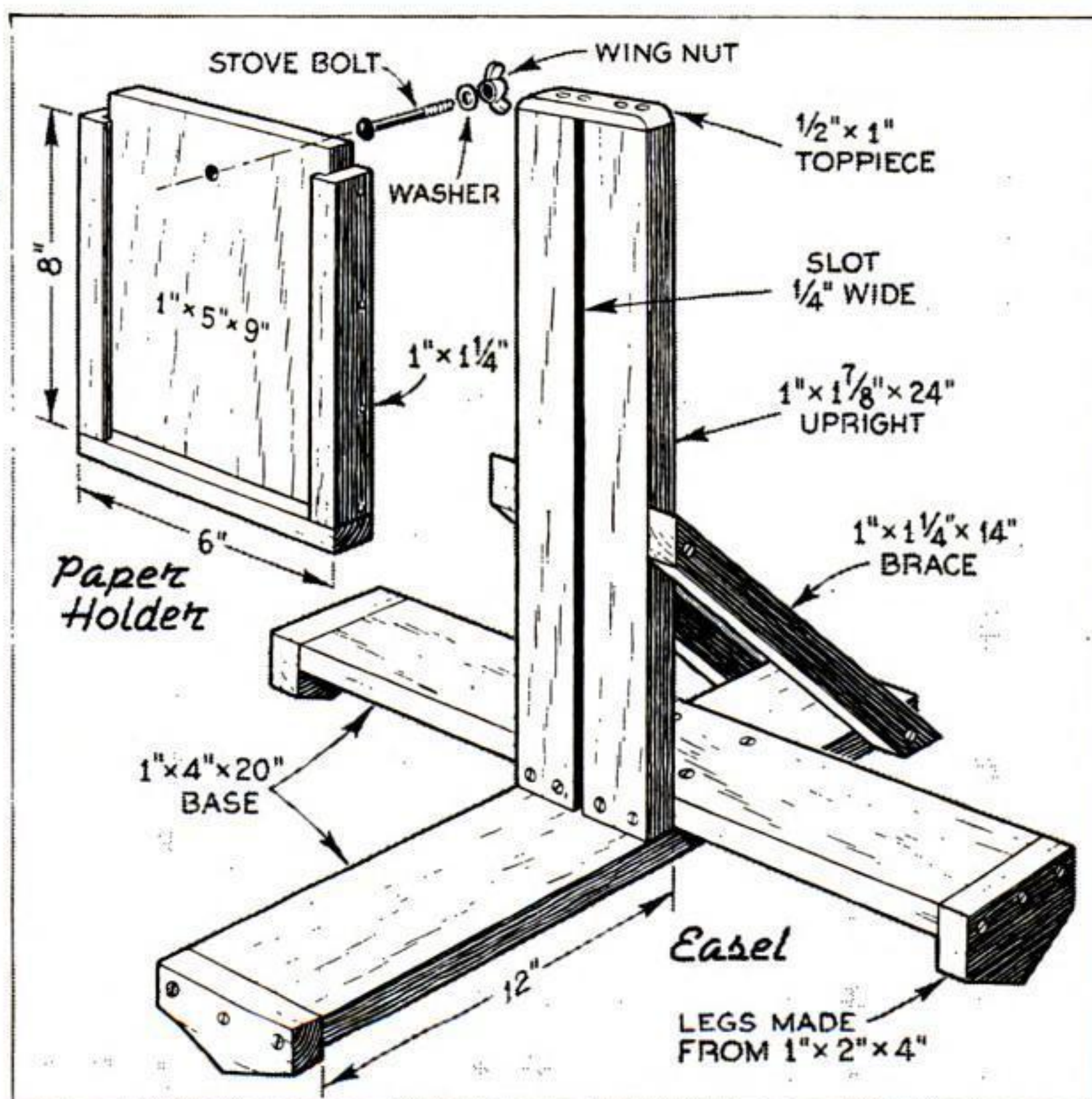
The focusing may be done on a piece of thin white cardboard

THIS easel for use with a horizontal enlarger was designed and built for the darkroom at the Maryville (Mo.) High School. It rests on three points to assure rigidity. The vertical member has a $\frac{1}{4}$ " wide slot down the center, and the paper holders are fastened on by means of a stove bolt and wing nut. The holder can be moved up or down or tilted to the right or left at will, giving all possible leeway for composing the picture as desired.

The materials: 2 pc. 1" by 4" by 20" for base; 2 pc. 1" by $1\frac{7}{8}$ " by 24" for uprights; 1 pc. $\frac{1}{2}$ " by 1" by 4" for toppiece; 2 pc. 1" by $1\frac{1}{4}$ " by 14" for braces; 3 pc. 1" by 2" by 4" for legs. For a 5" by 7" paper holder, the following is required: 1 pc. 1" by 5" by 9" for the back; 2 pc. 1" by $1\frac{1}{4}$ " by 8" for the sides, which are rabbeted as shown; and 1 pc. $\frac{1}{2}$ " by $1\frac{1}{4}$ " by 6" for the bottom.

The wood should be painted dead black, and the easel should be used on a table top also painted black, or covered with black cloth.

Several holders were made to take standard sizes of paper such as 5" by 7", 8" by



How the easel is made. The paper holders may be any size

10", and 10" by 14". The paper slides down the grooves along the sides until it comes against the stop at the bottom. If the enlarger does not have a filter over the lens for focusing, sheets of white cardboard can be cut to slip in the holders while focusing. If a white border is desired all around the picture, a mask may be slipped in front of the sensitized paper.—C. W. RICKMAN.



Sandpaper Gives Prints a Pebbled Surface

WHEN an artistically rough surface is desired on photographic prints or enlargements that have been made with smooth paper, try sandwiching the slightly damp sheets between pieces of coarse sandpaper and allowing them to dry under pressure.—K.R.

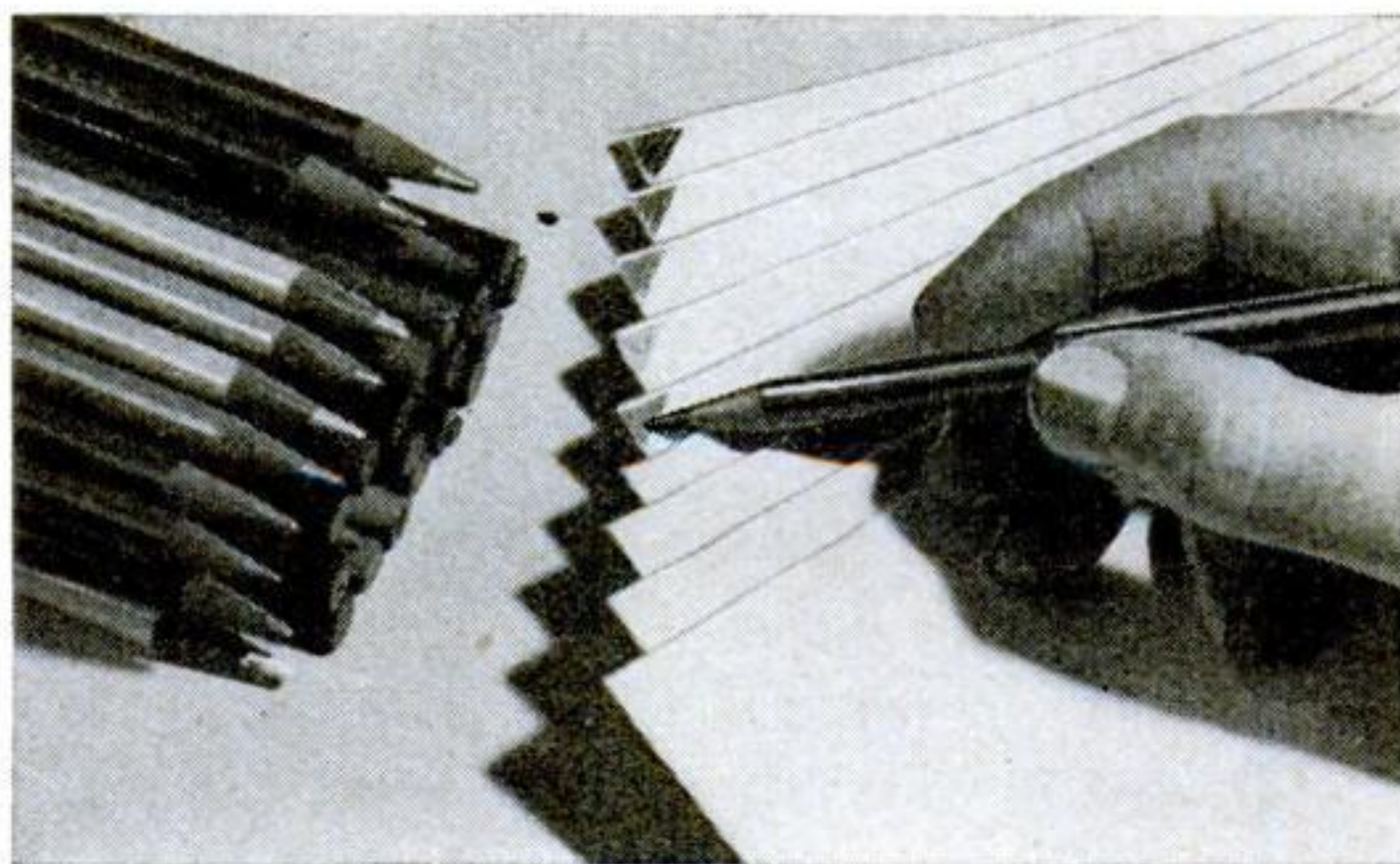
Negatives Handled with Tweezers

SCARS and smudges on negatives can be avoided by the use of a holder made by cementing a square of rubber inside the end of each leg of a pair of ordinary household tweezers. Whether picked up with these holders or by hand, negatives should always be grasped as close as possible to the edge.—W. PHAIR.



Finding Negatives Quickly

NEGATIVES are often filed in envelopes according to type, as portraits, outdoor, children, and the like. To locate the envelopes of any particular classification, mark the upper left-hand corner of each with a colored pencil or crayon, each color denoting a class.



ACID-HARDENING FIXING BATH

[PHOTOGRAPHY]

Water (about 125 deg. F. or 52 deg. C.)	64 oz.	or	2 liters
Hypo	16 oz.	"	480 grams

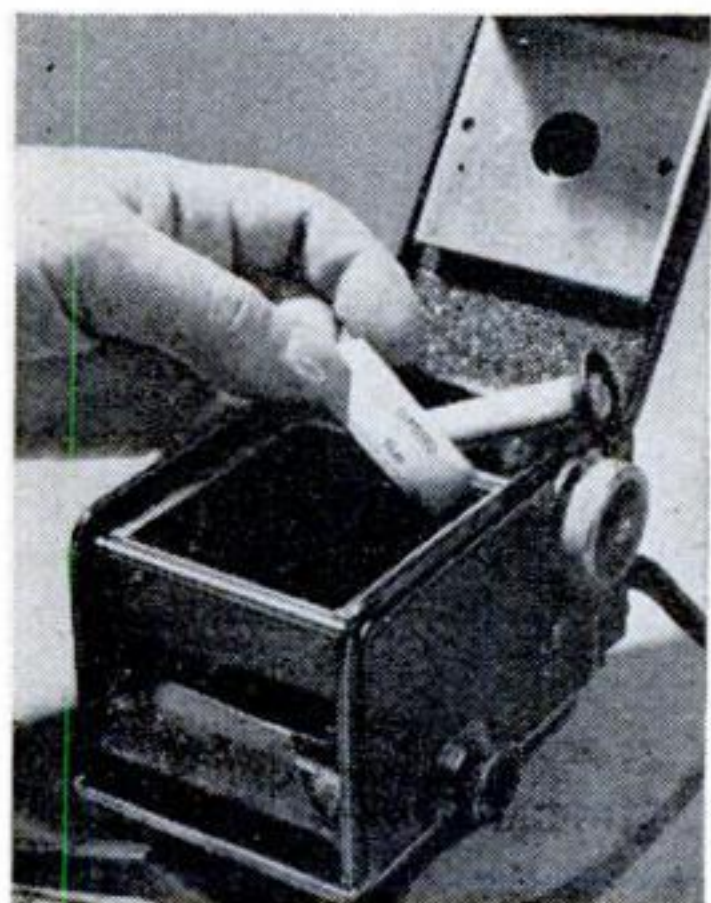
When thoroughly dissolved, allow it to cool; then add the entire quantity of the following hardening solution:

Water (about 125 deg. F. or 52 deg. C.)	5 oz.	or	160 cc
Sodium sulphite (anhydrous or desiccated)	1 oz.	"	30 grams
Acetic acid (28% concentration)	3 oz.	"	96 cc
Potassium alum	1 oz.	"	30 grams

Dissolve the chemicals thoroughly in the order given and stir rapidly while adding the second solution to the first. The normal fixing time of this bath is from five to ten minutes at from 65 to 70 deg. F. or 18 to 21 deg. C. A 28% concentration of acetic acid may be obtained by adding three parts of glacial acetic acid to eight parts of water.

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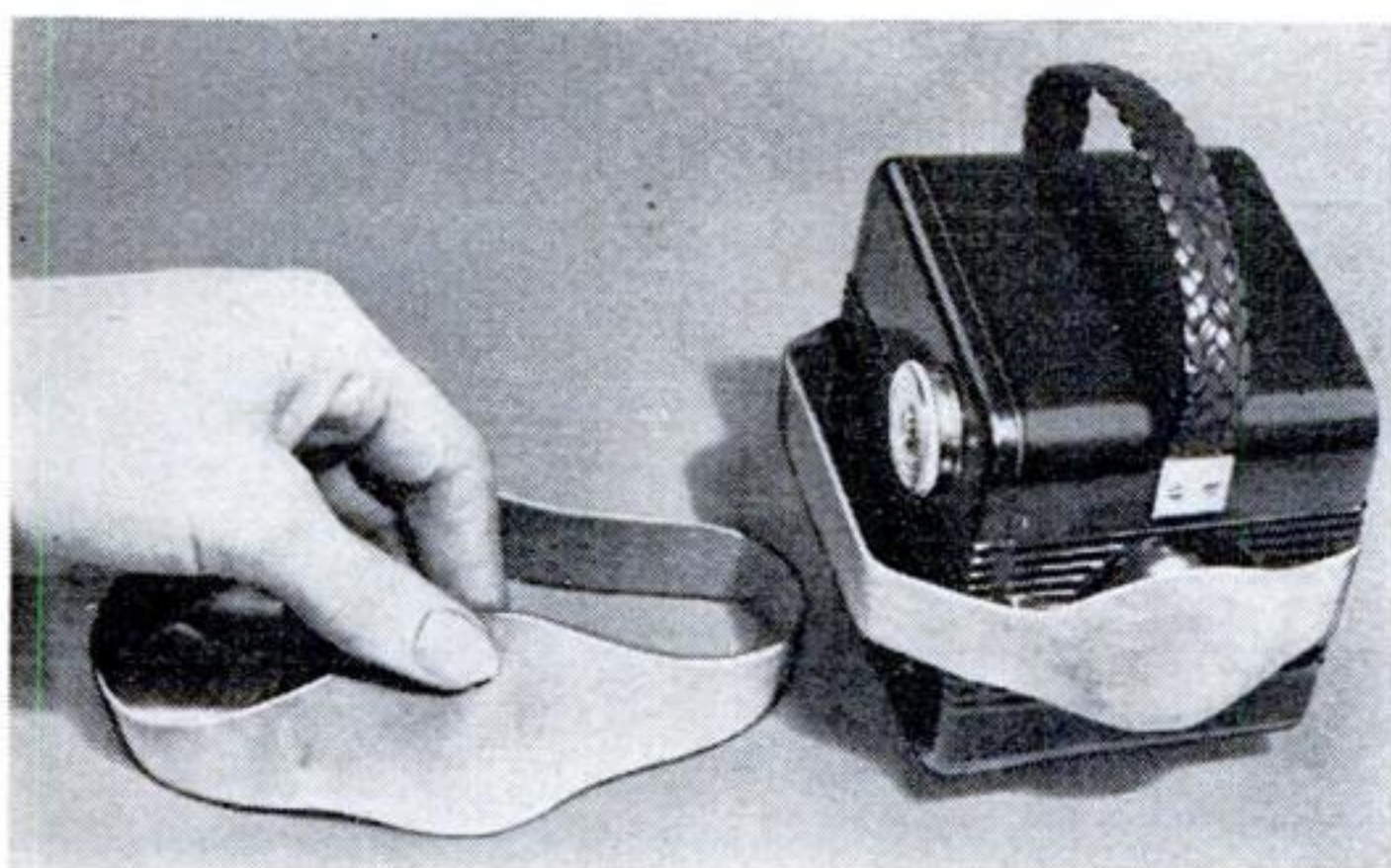
Keep Gummed Tab Intact



SOMETIMES part of the gummed tab at the end of a roll of film is found to be missing when the exposed roll is removed. Always look for it in the camera before re-loading or it may drop behind the lens and ruin subsequent exposures.—W.K.

Rubber Band Guards Lens

DUST can be kept from the unprotected lens of a so-called "box" camera by cutting a band as shown from an old inner tube and stretching it around the camera. This also saves the film from exposure in case the shutter is accidentally tripped.—B. N.



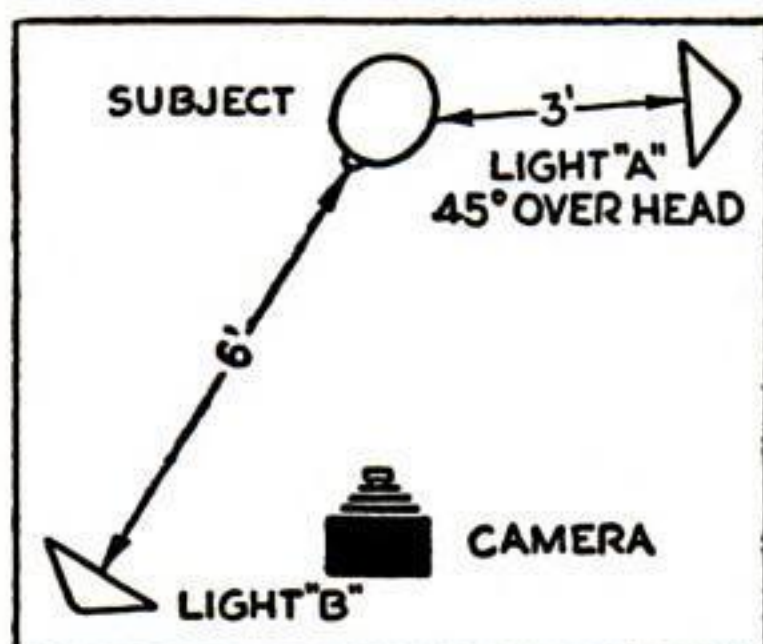
Cable Release Provides Press-Button Control

MINIATURE cameras can be equipped with a press-button release by looping the cable release as shown above and securing it to the camera with a rubber band. If the camera is then held in the manner illustrated, with the fingers of the right hand gripping the cable, snapshots can be taken by depressing the release with the forefinger in the conventional press-button fashion.—L.H.

PORTRAITS WITHOUT HEAVY SHADOWS

[PHOTOGRAPHY]

Two small photoflood lamps are used for light A, and two more for light B. Dominant light A is slightly behind the head in relation to the camera, thus throwing the opposite side of the face completely in shadow, which, in turn, is lighted by B. Exposure is determined by light B. In this example it was 1/5 sec. at F/4.5 on supersensitive panchromatic. If clothing is dark, without a white collar, increase exposure. In all portrait work give full exposure.



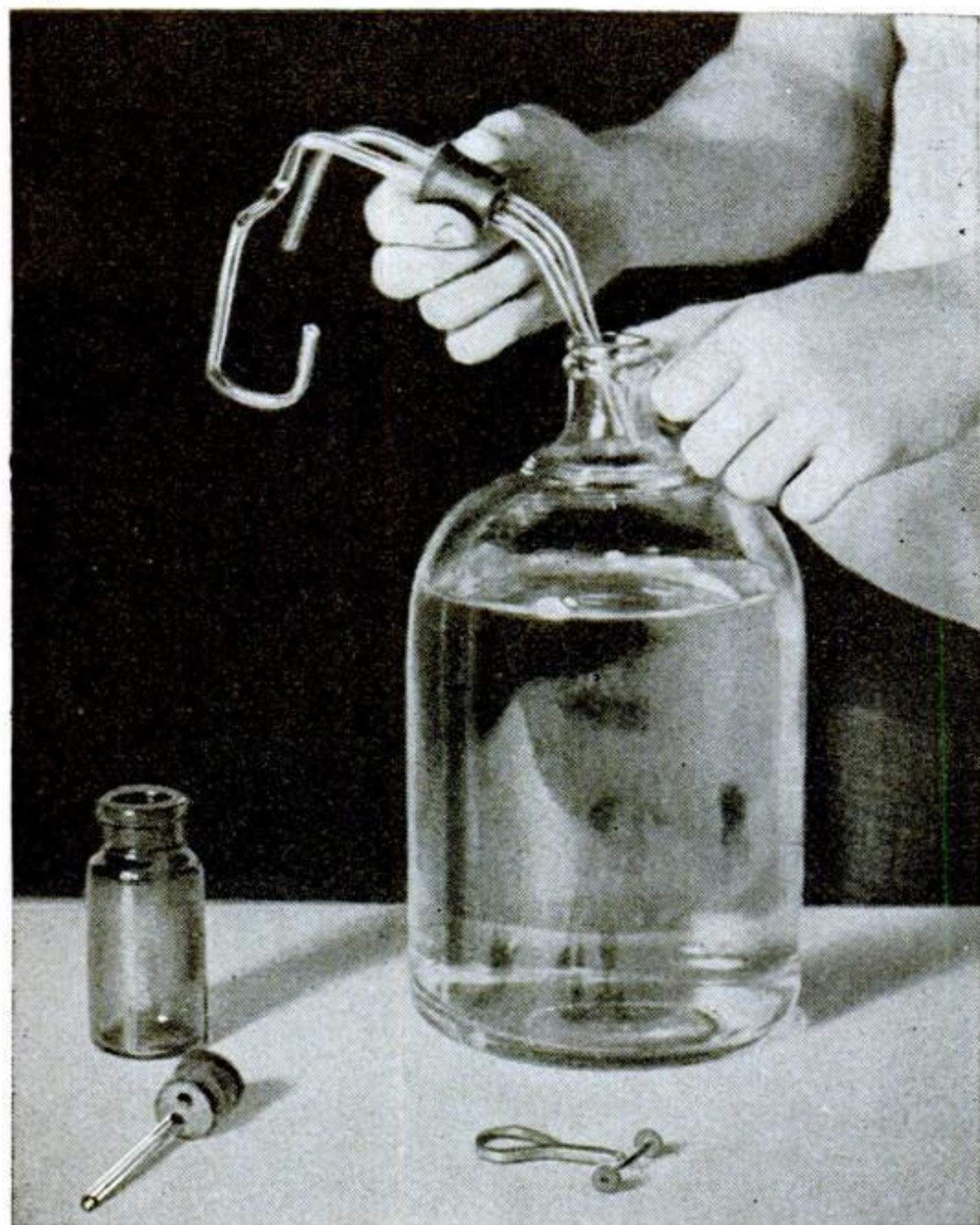
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Oxygen Absorber Keeps Developer from Spoiling

DEVELOPING solutions for films and prints can be kept for future use if stored in tightly stoppered and completely filled bottles, but a much better method is to attach an oxygen-absorber bottle at the air intake of each developer supply bottle. The materials necessary are a gallon size and a 3-oz. bottle, glass tubing, and a small piece of rubber tubing, two double-holed rubber stoppers to fit the bottles, and two pinch-stop clamps. The chemicals necessary are pyrogalllic acid (pyro) and sodium hydroxide (caustic soda).

Bend the glass tubing by revolving it in the flame of a Bunsen burner until red with heat. The measurements given in the drawing need only be approximated. When cool, insert the glass tubing into the rubber stoppers. Wetting the glass will help it to slip through. Assemble the rubber tubing and pinch cocks.

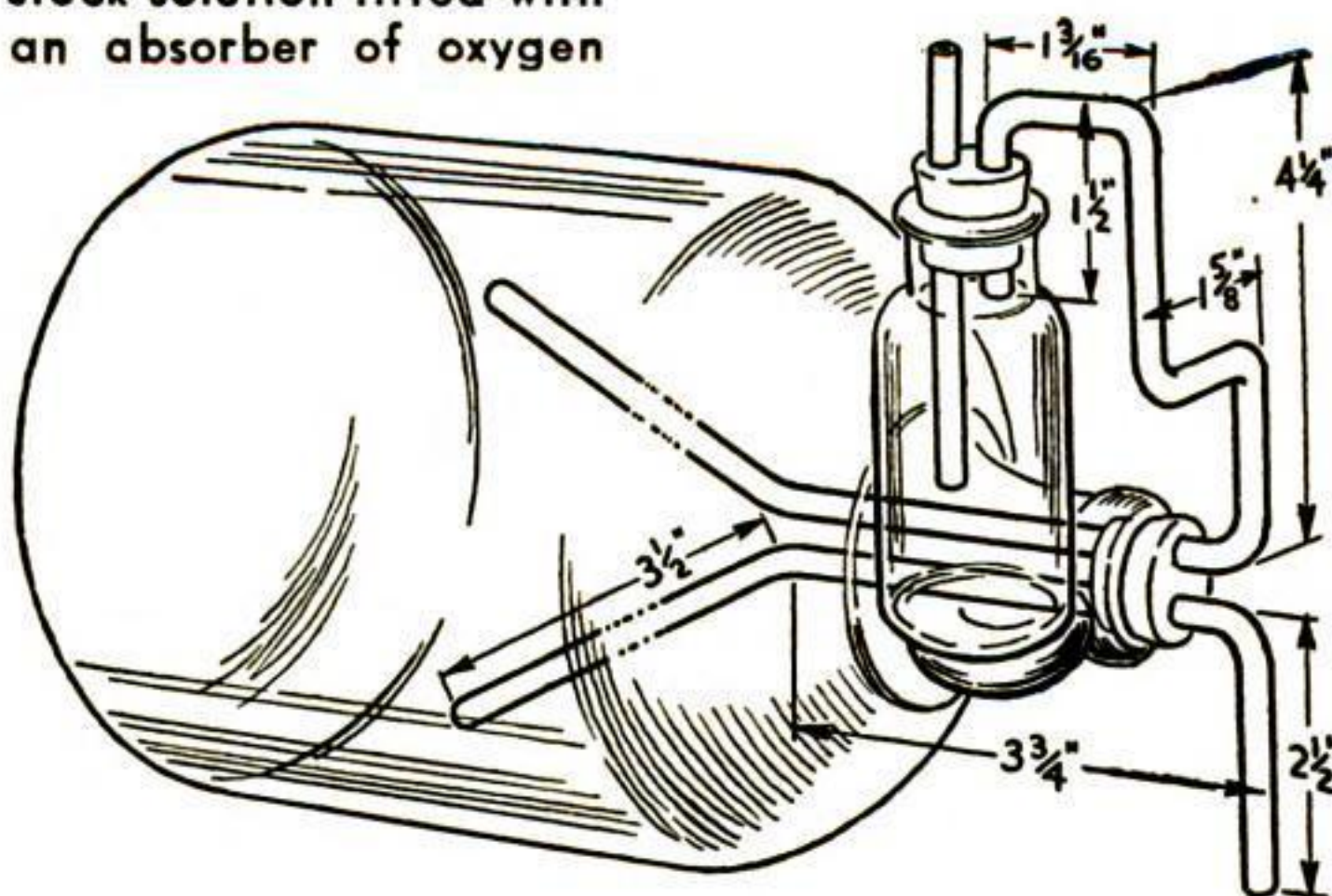
After your batch of developer has been



The bent ends of the tubing are turned parallel for insertion into the bottle and separated afterwards



Drawing off developer from a gallon bottle of stock solution fitted with an absorber of oxygen



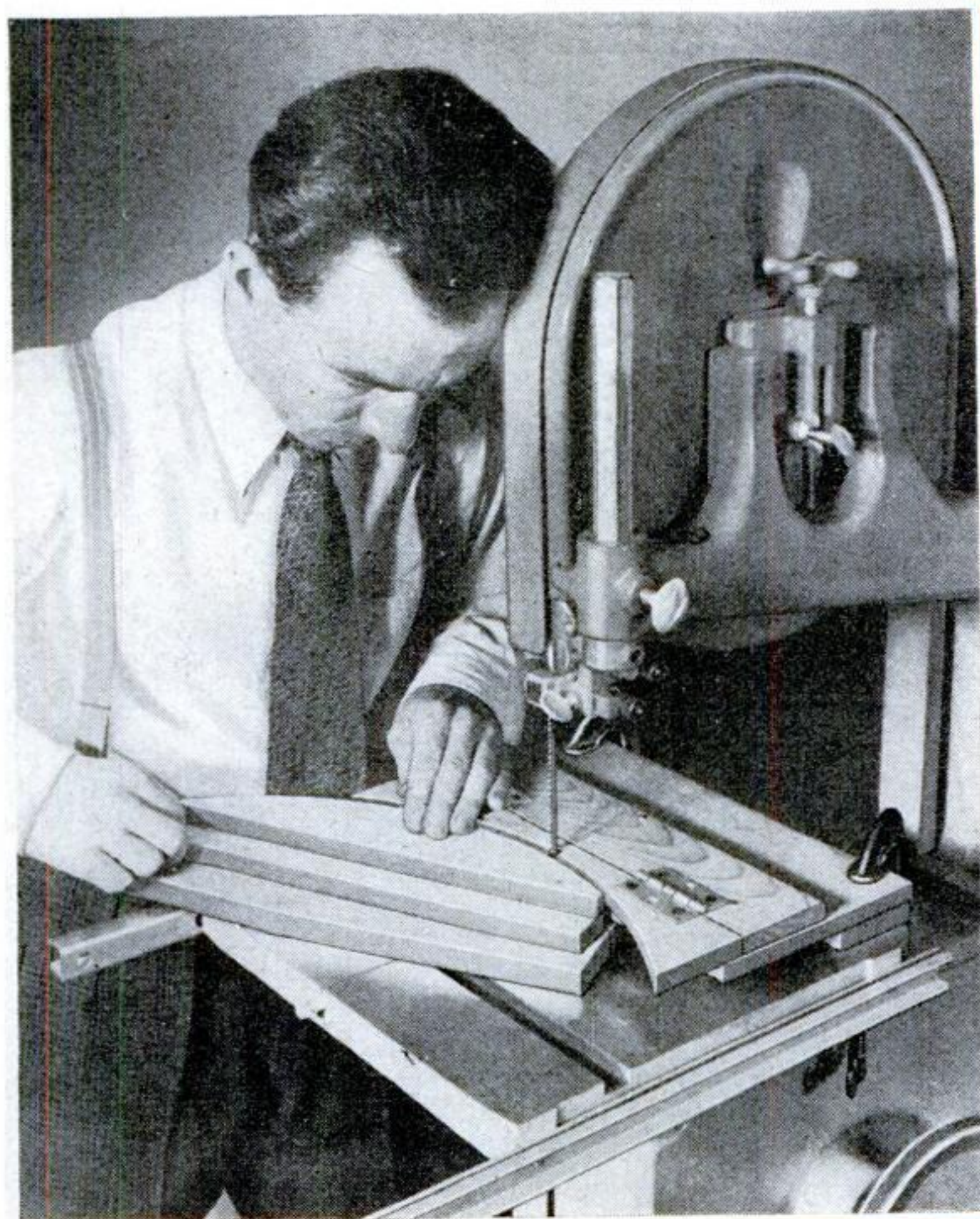
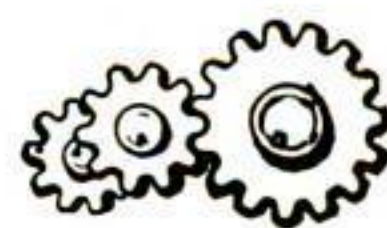
How the tubing is arranged so that air must pass through the small bottle before entering the large

prepared, connect the rubber stopper with the glass tubing to the supply bottle. To do this, swing the tubes in the stopper together and spread them out again after the stopper has been inserted, as shown. In the 3-oz. bottle dissolve $2\frac{1}{2}$ grams of pyro in $1\frac{1}{2}$ oz. of water. When everything is ready, add to the pyro $\frac{1}{2}$ oz. concentrated sodium hydroxide, and insert the rubber stopper.

As you draw off the developer to be used from the bottom of the bottle, the air that rushes in to take its place must first pass through the oxygen-absorber bottle to eliminate most of the oxygen in the air, which spoils the developer.—JEROME UHRIG.



new SHOP IDEAS



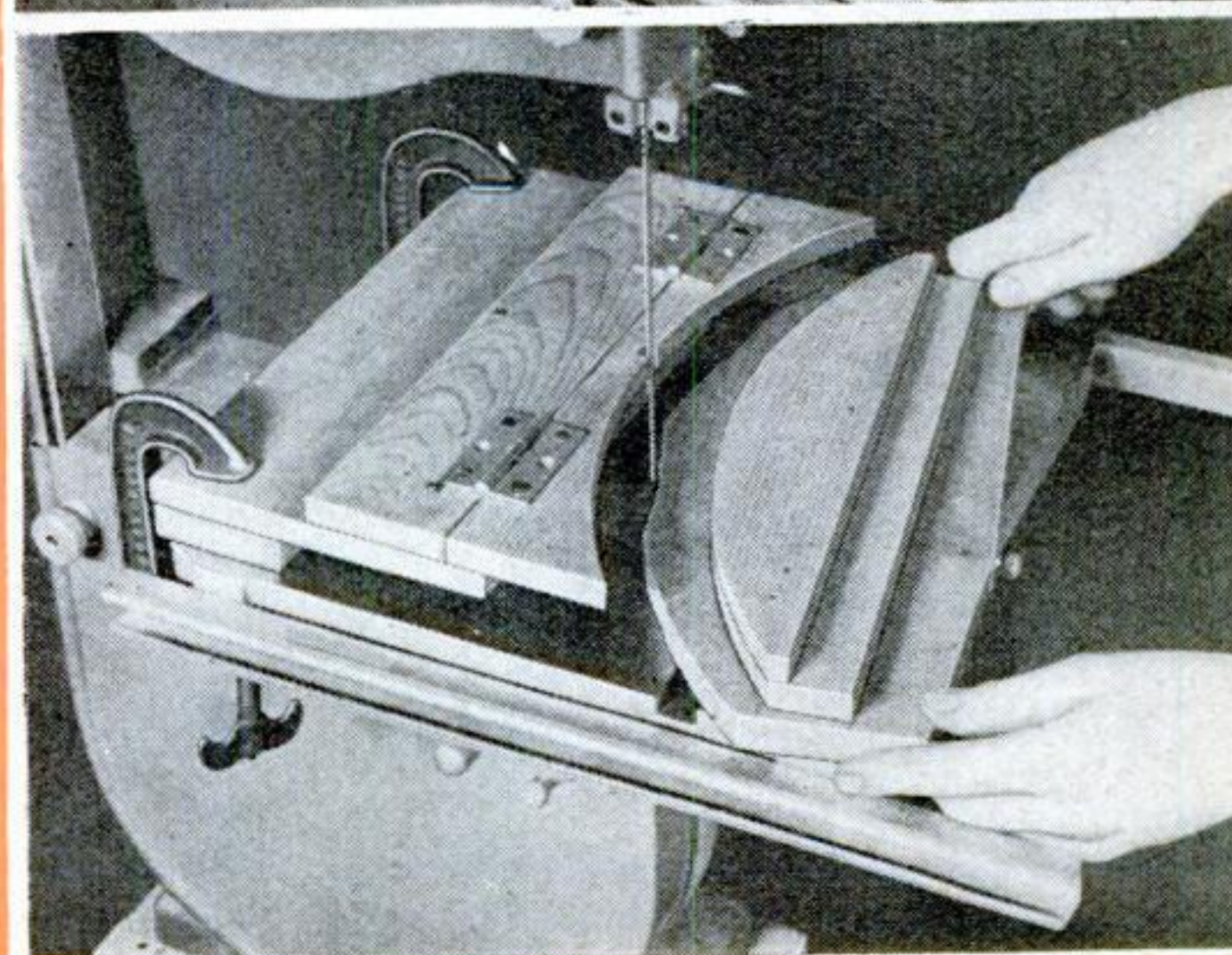
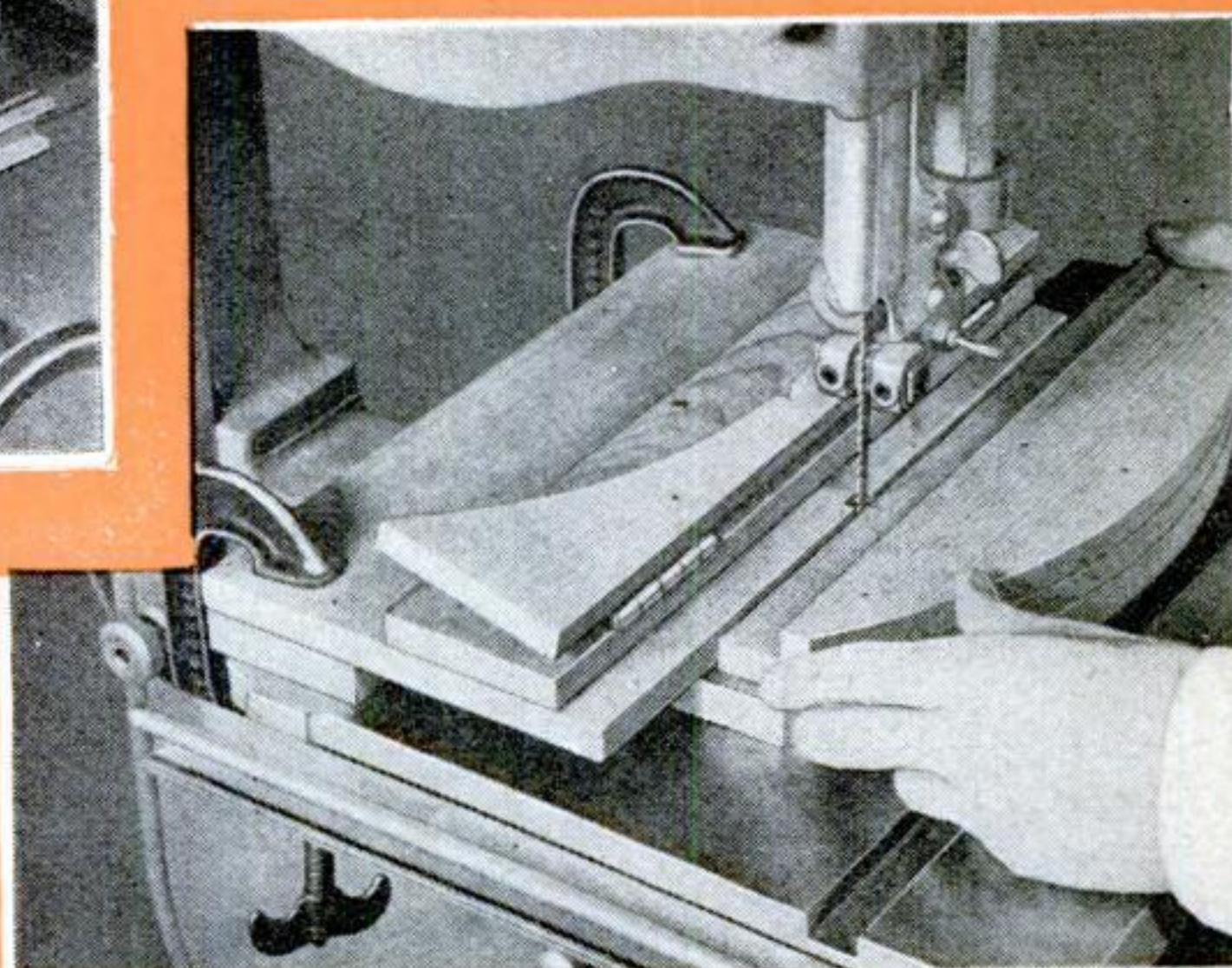
Pattern Sawing

SPEEDS UP WORK OF CUTTING DUPLICATE WOODEN PARTS

Above, band-sawing curved side of work. At right, the curved guide has been swung back for cutting the straight parts. Below, a two-piece pattern is used on top of the work

SAWING to a pattern, or "pattern sawing" as it is more often called, is one of the few production wood-working methods that is equally well adapted to the home workshop. Since it requires little more than a pattern and one of a few easily constructed types of jigs, this method is useful where several duplicate parts must be made. Not only does it eliminate much tedious layout work, but it enables scrap material to be quickly brought to shape. One of the advantages of the method is that even an inexperienced operator cannot possibly cut the material too small.

By **HOWARD R. HEYDORF**



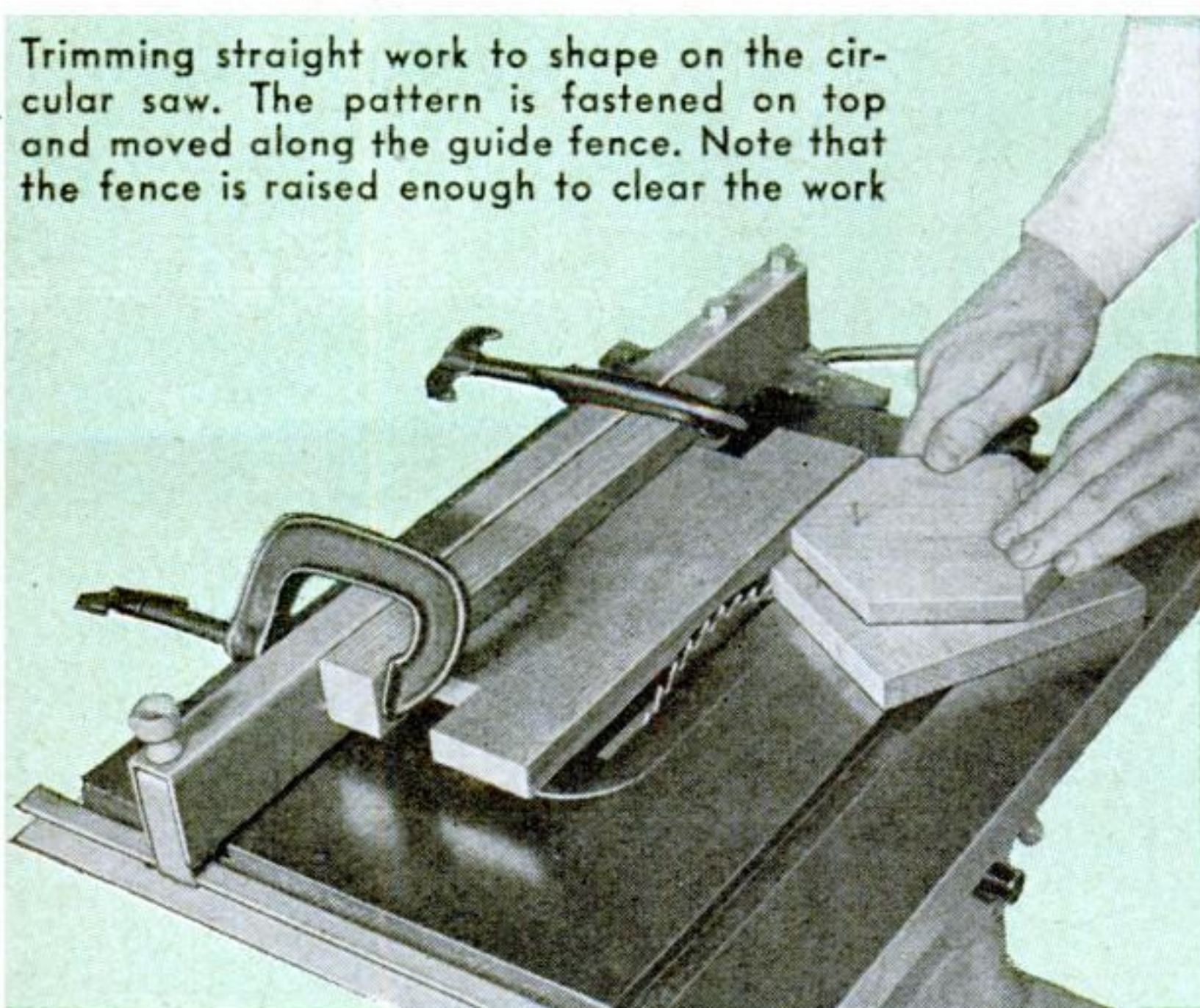
There are several different jigs that may be used, depending upon the type of work. Odd-shaped pieces with straight sides may be cut to shape expeditiously with the circular saw as shown below. A wooden guide fence is clamped to the regular ripping fence, and this extra fence clears the saw table sufficiently to allow the material to slip below it. A small rabbet is cut on the lower side of the outer edge of this fence to permit the blade of the saw to be set so that the outer teeth are exactly flush with the edge of the wooden fence. A pattern cut to the shape of the article also is needed. This is fastened to the material with small nails or discarded phonograph needles, which are very good for this purpose. After the pattern is secured to the stock, it is guided along the wooden fence, and the work is thus trimmed to the exact shape of the pattern.

When it is undesirable to have the fine indentations of the nails in the surface of the

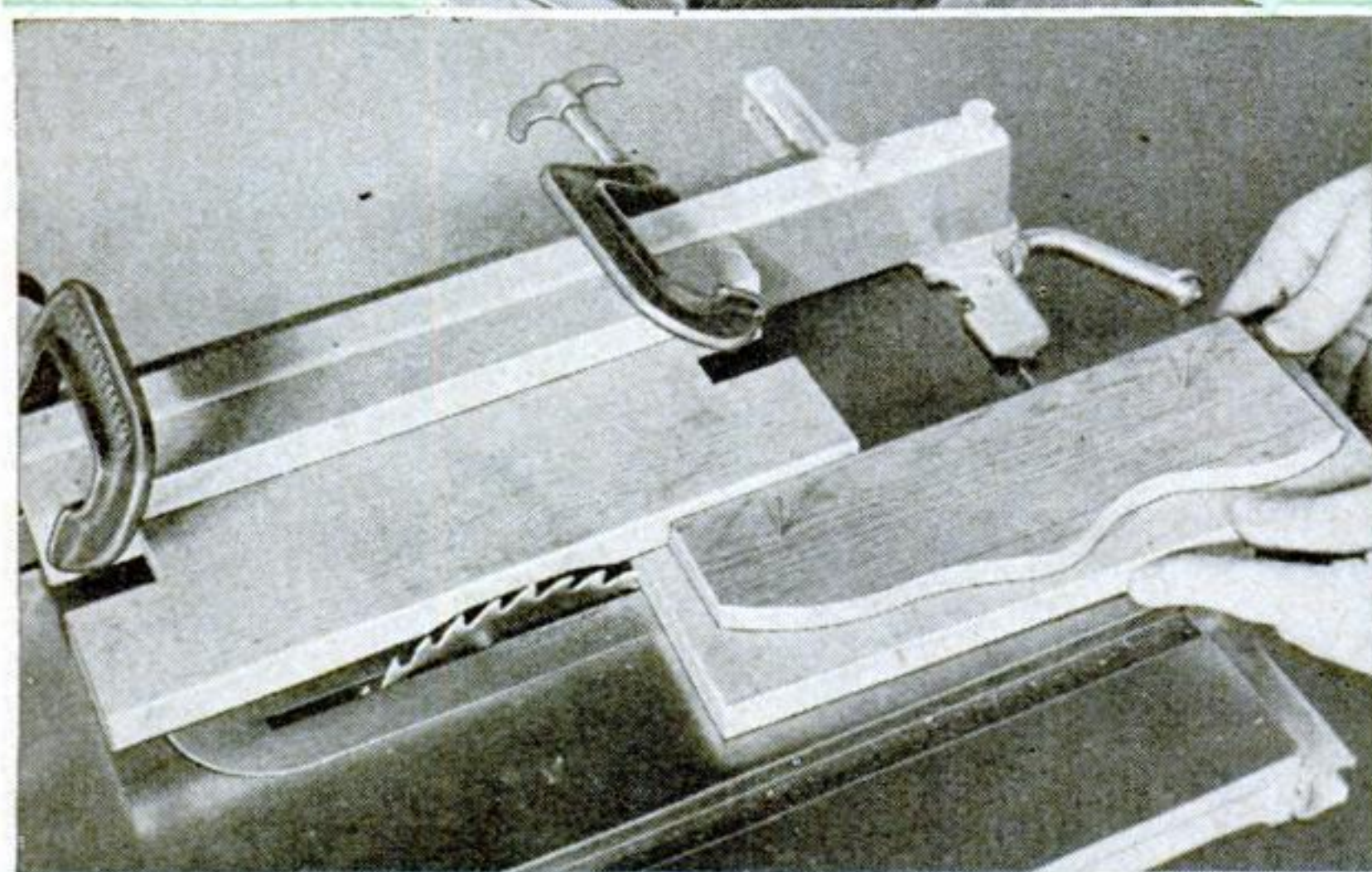
work, a frame may be made as shown to fit the work snugly. This is used in the same manner as a regular pattern.

Pattern sawing may also be done on the band saw provided the curves are not too abrupt. A wooden arm is clamped to the saw table as illustrated on the facing page. This arm is blocked up enough to allow the material to pass under it. The end of the arm is cut in a curve, the radius being the same as the smallest curve to be cut, and a shallow cut is made in this end to take the saw blade. The pattern is made and fastened to the material. The work is pushed into the saw until the pattern rests against the end of the wooden arm. It is kept in contact with the arm while the cutting is being done. To insure perfect work, the pattern must be kept at a tangent to the arm. Radial lines marked on the pattern will be an aid in doing this. As the pattern is moved during the cutting, these lines are kept in line with the arm.

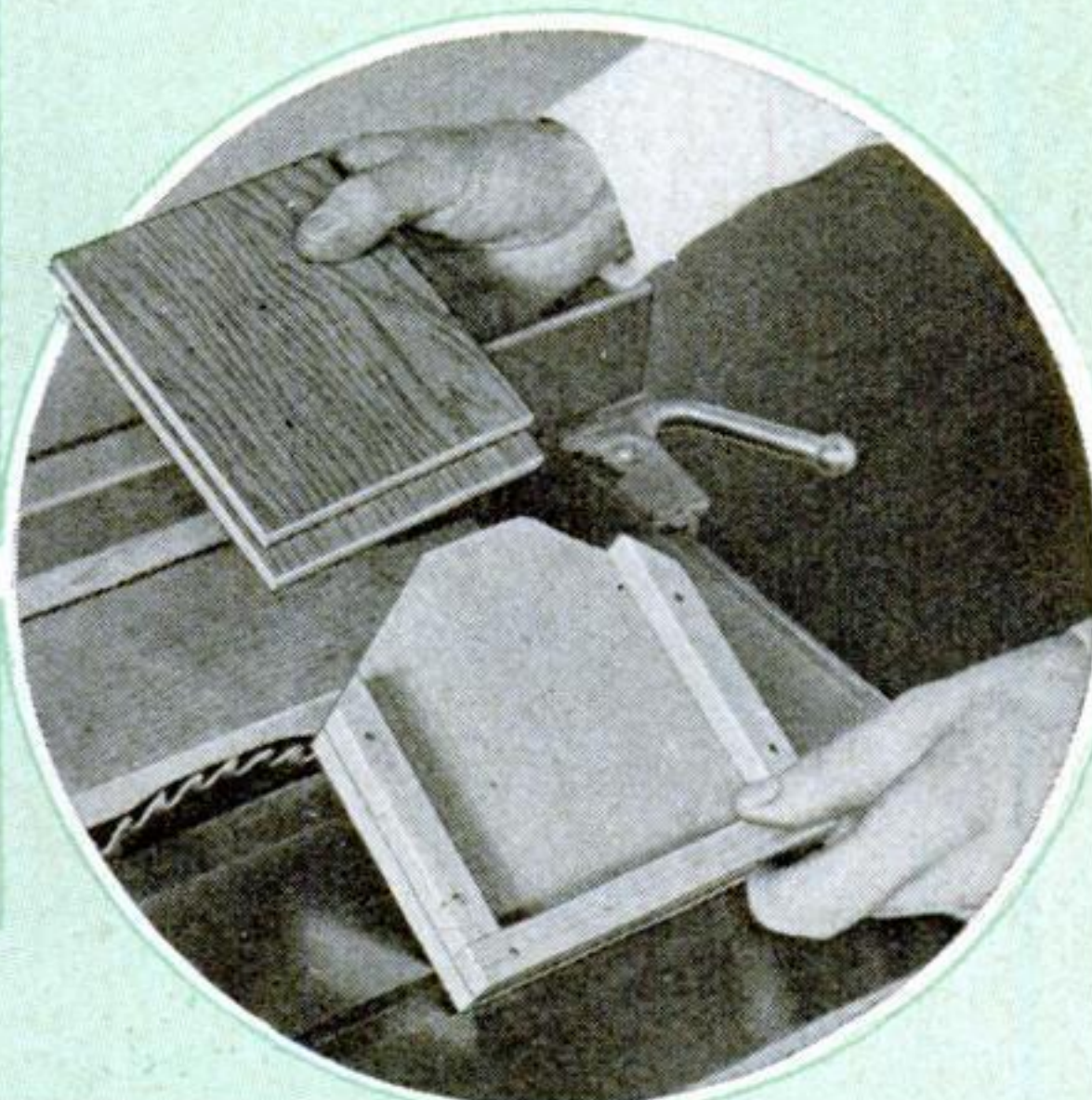
Trimming straight work to shape on the circular saw. The pattern is fastened on top and moved along the guide fence. Note that the fence is raised enough to clear the work



To avoid nail marks on the work, a box jig may be used. The jig is made and loaded as shown in the photograph below

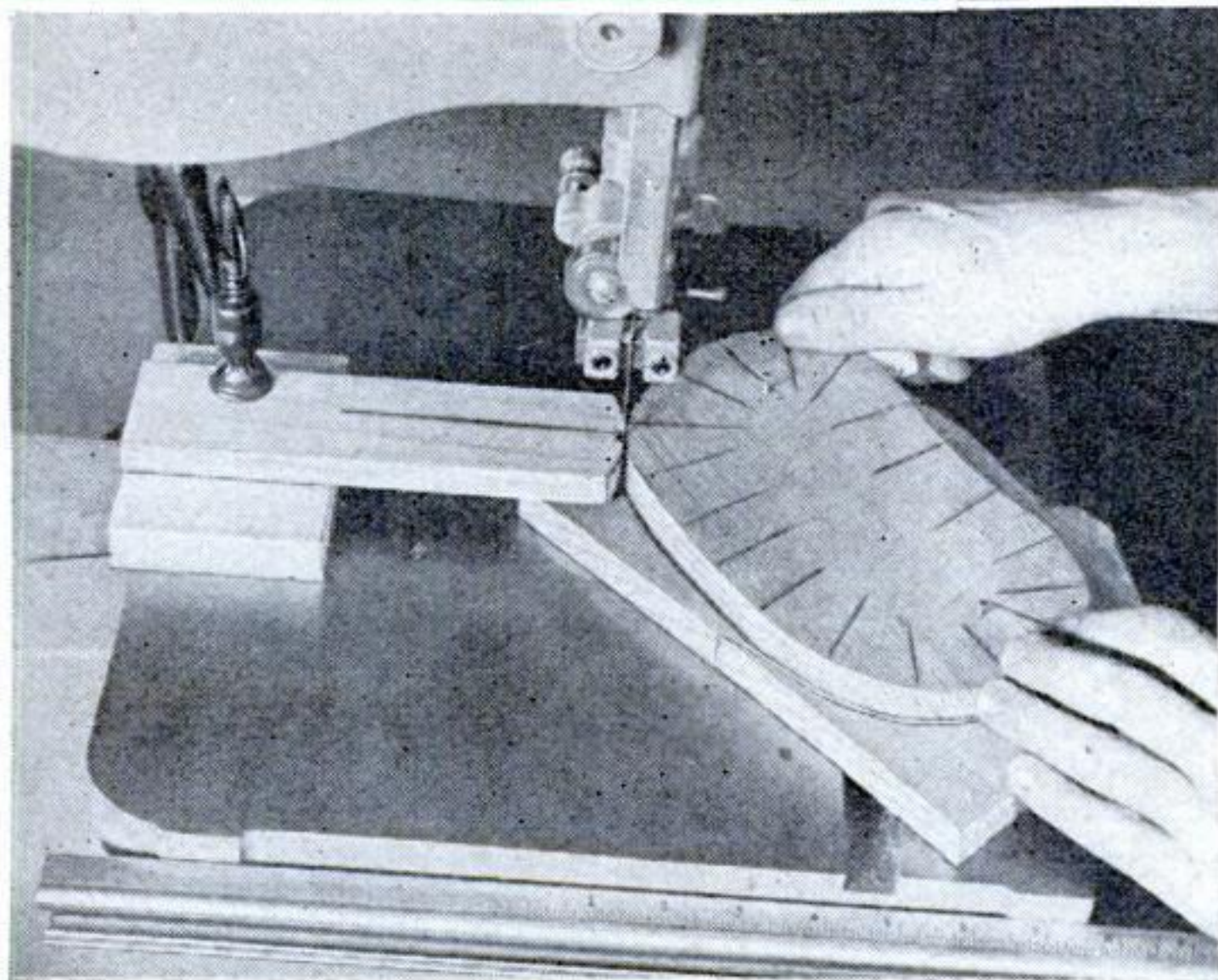


If a pattern is part straight and part curved, the straight edges are usually cut on the circular saw before band-sawing



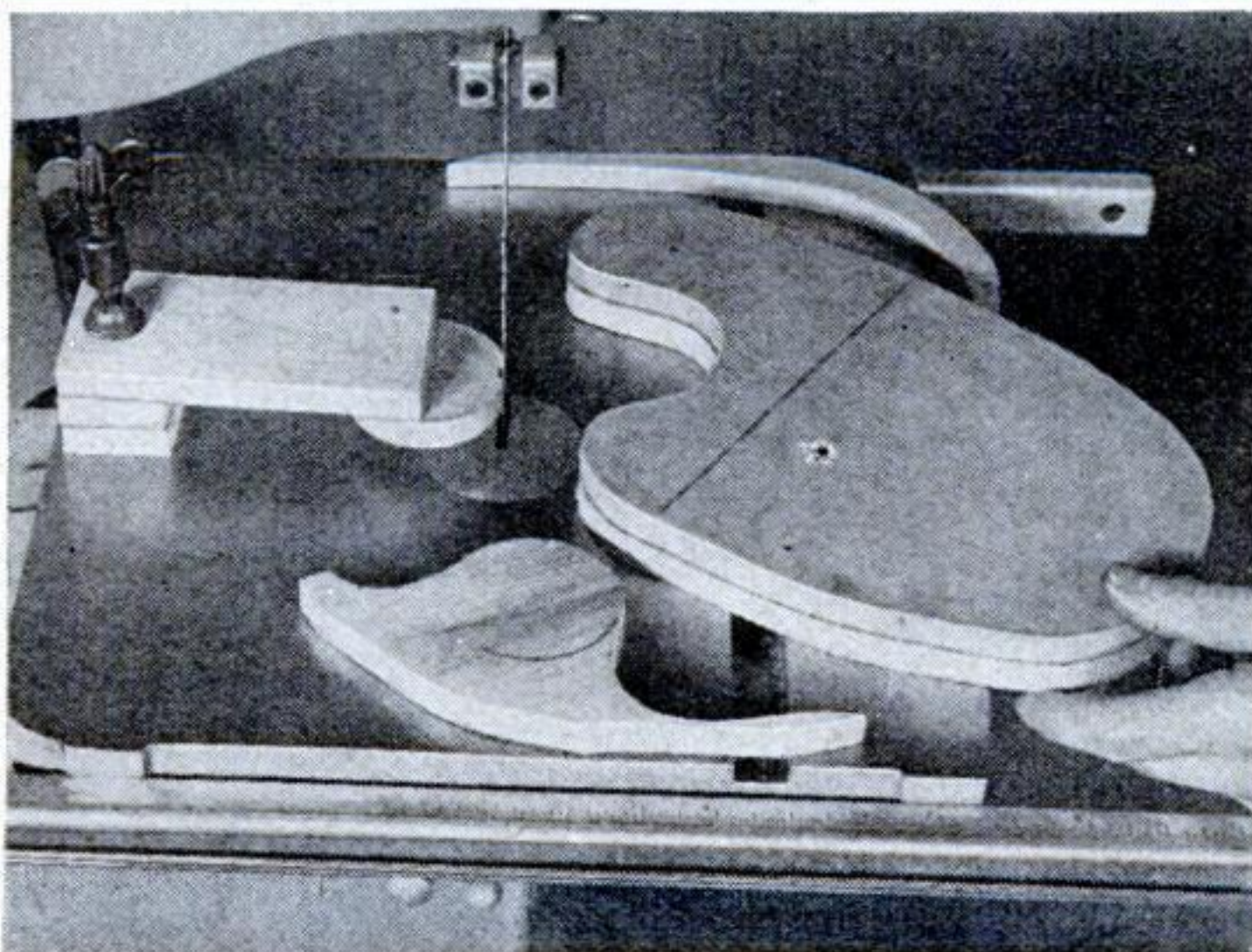
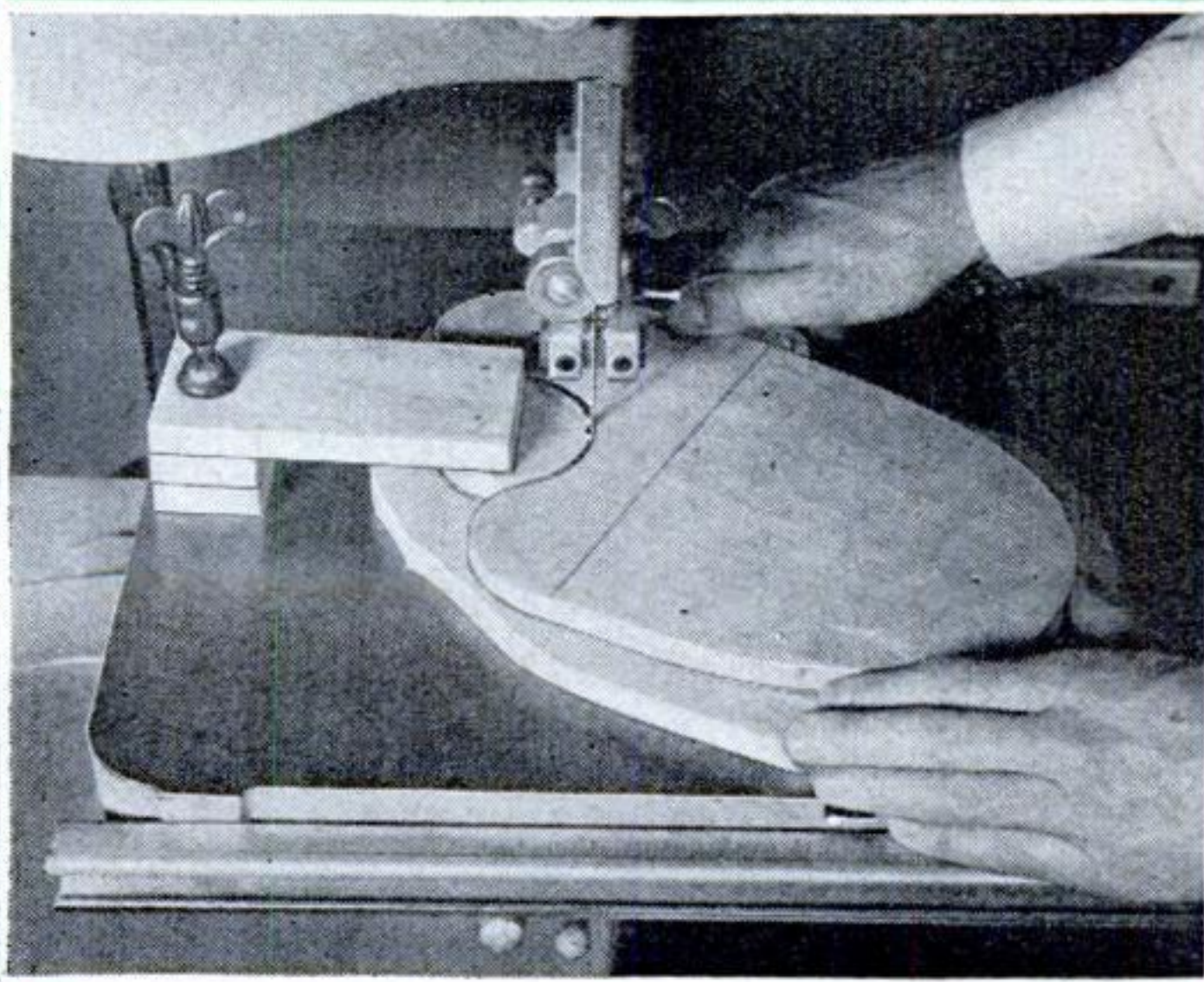
On work where inside curves must be shaped, the end of the arm may be fitted with a small wooden disk. This works in the same manner as the end of the arm, but allows the pattern to revolve around it. The radius of the disk should be the same as that of the smallest curve to be shaped.

Another method of pattern cutting on the band saw is shown on the next page. Here the work is placed in a box jig. One side of this jig is cut to the exact shape of the work. The saw blade merely passes along the edge of the pattern. Sometimes this method may be used in finishing up work after the wooden



Using a wooden arm to follow the pattern of a table-leg base. The end of the arm is curved, and notched slightly for the saw blade. It is blocked up to clear the work and clamped securely

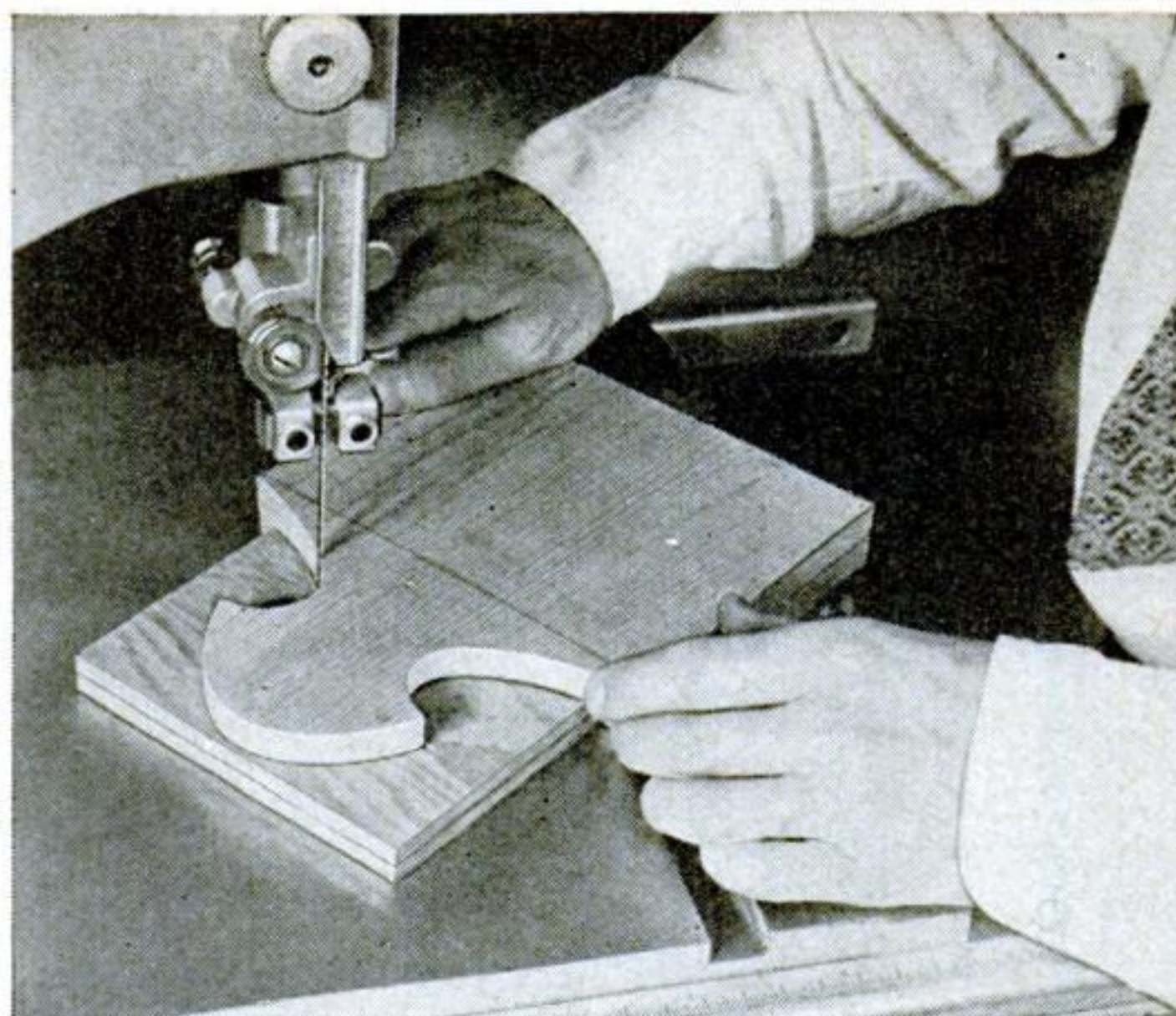
The pattern must be kept at a tangent to the end of the guiding arm. This can be done more easily if radial lines are marked on the pattern



At left, for work with inside curves, a wooden disk may be attached to the arm. The radius should be the same as the smallest curve to be cut. The pattern can then be revolved around the disk without difficulty as illustrated above

arm has been used to do all accessible cutting.

Slow, even curves and straight edges often must be cut on the same piece. A simple combination jig for this purpose is illustrated at the beginning of this article. A straight guide fence is clamped to the saw table, and the front edge is notched for the saw blade. On top of this fence is fastened a straight strip to which is hinged a piece of wood with a curve of the same radius as that of the pattern. The pattern which is to be fastened to the material should have the curved side built up so that it will slide along the edge of the jig. To cut this portion of the work, the pattern is moved along the curved guide fence. To cut the straight sides of the work, the curved fence is swung back and the straight fence is used in the same manner as on the circular saw. While a jig of this type takes a little longer to make, it saves much time on duplicate work.



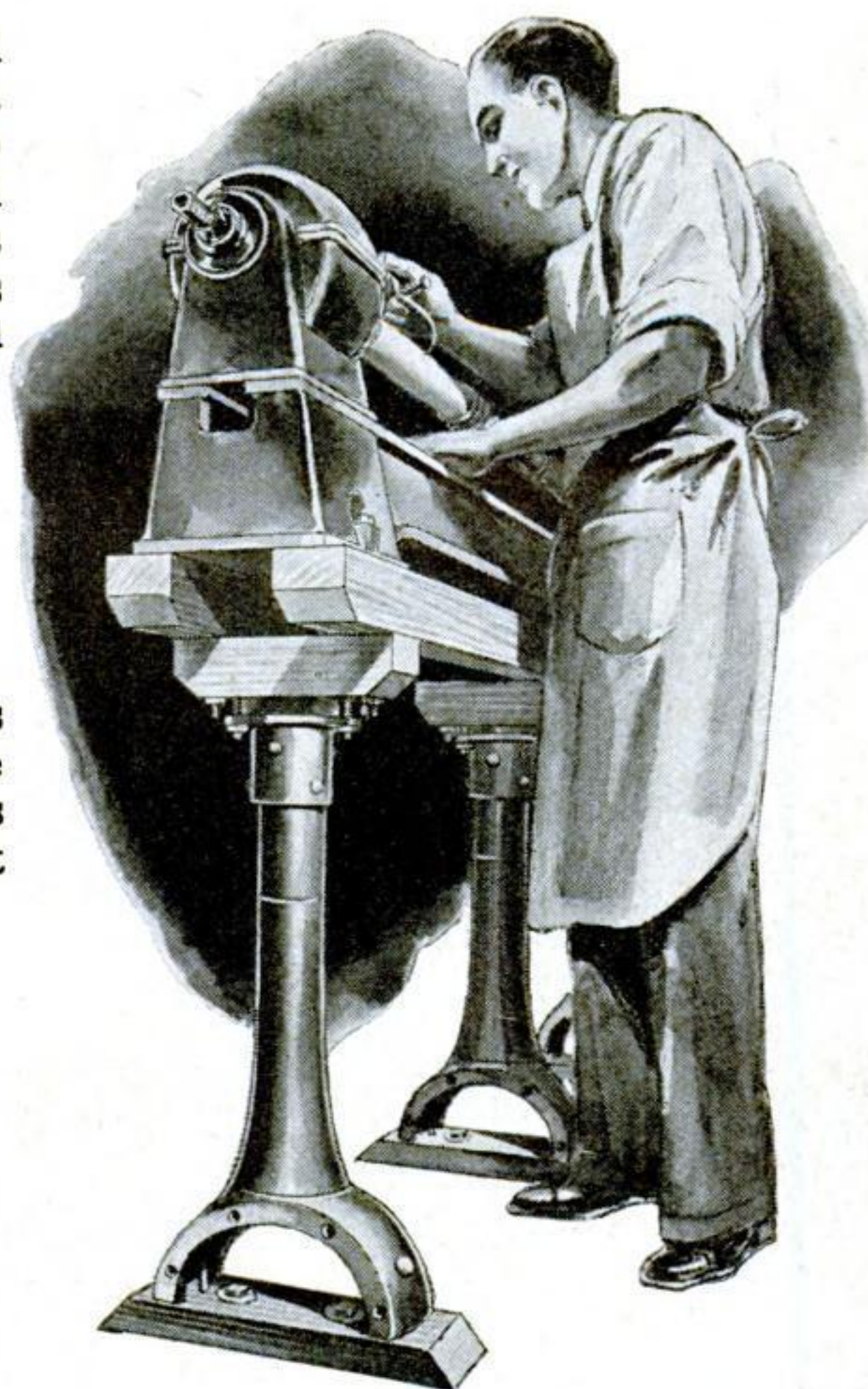
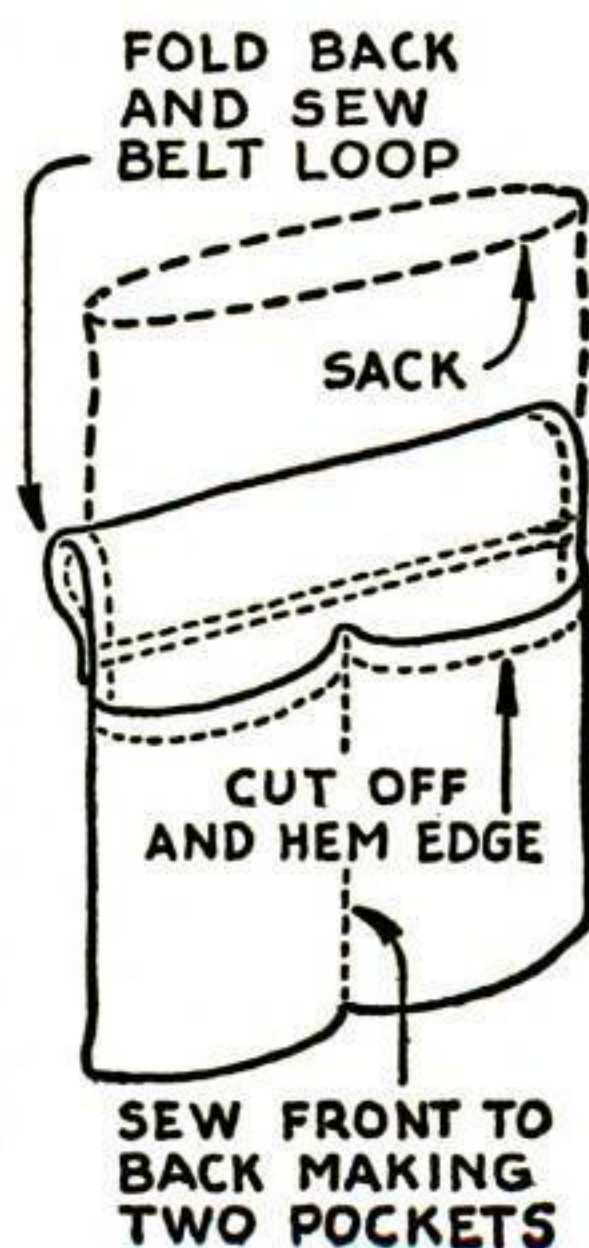
If a wooden arm cannot conveniently be used, the work may be placed in a box jig. Any small corners are trimmed after the rest of the cutting is done

Junked Rear-Axle Housings Support Machine Bench

A STURDY machine bench can be made from junked rear-axle housings as shown at the right. Such a bench is not only neat in appearance, but also easy to clean around. Cross rails for the bench top are bolted to the small end of each housing through the holes that formerly held the brake assembly. The large ends are fastened to the floor with lag screws, or are bolted to wooden crosspieces screwed to the floor.

Small Sack Quickly Converted into a Carpenter's Apron

WHEN much nailing is to be done, a carpenter's apron is a real timesaver. One can quickly be made from any small cloth sack. It is folded and cut as shown in the sketch below, then sewn to form a belt loop and two pockets for holding nails.

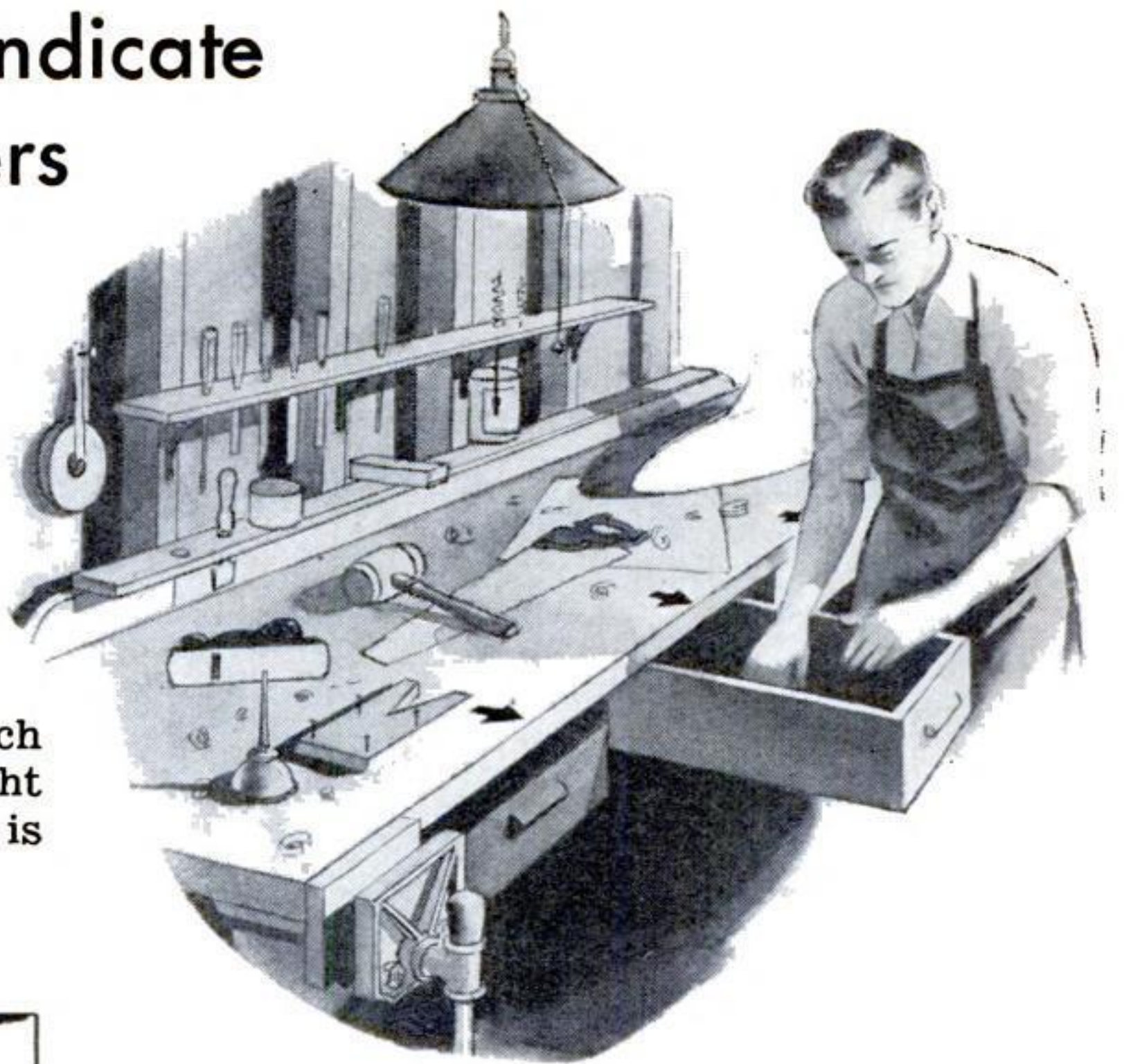


A lathe and a jig saw are mounted on this long, substantial bench, which has four legs made from old axle housings

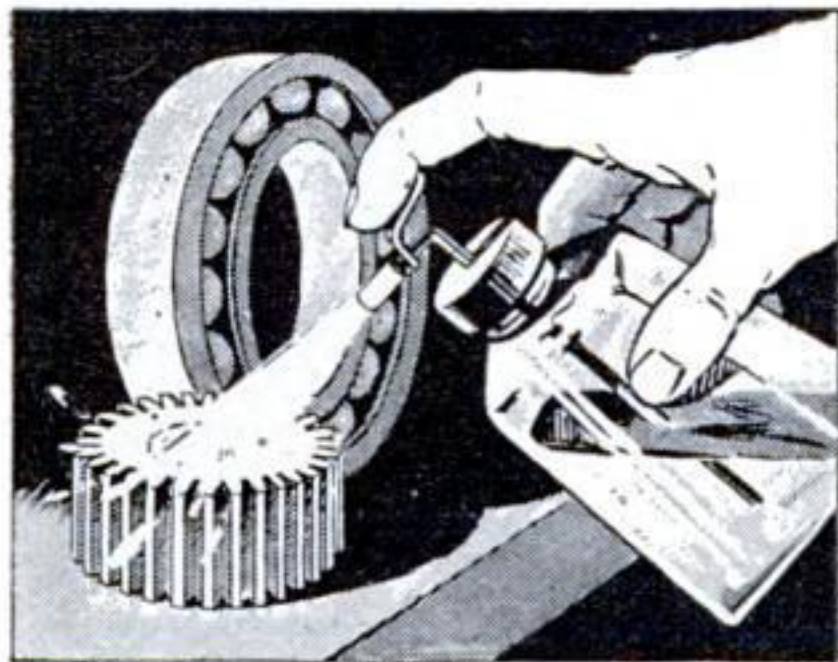
A substitute for a carpenter's apron is made by cutting and sewing a small sack as at the left. It is worn by slipping the belt through the hem or loop at the top

Bench Top Marked to Indicate Location of Drawers

LIKE many homemade workbenches, mine is a long one with four drawers that slide underneath the top. When closed, the drawer fronts are not flush with the front of the bench top, but set back a little so they cannot readily be seen without stooping. To avoid having to stoop or feel around under the overhang of the bench top to find the drawer handles, I painted a broad arrowhead with black lacquer at the edge of the bench directly over each drawer handle. A straight line would do just as well, but an arrow is somewhat neater.—ROBERT C. KING.



Metal parts may be conveniently cleaned of dirt and grease with the aid of a discarded sprayer of the type used for cleaning windows

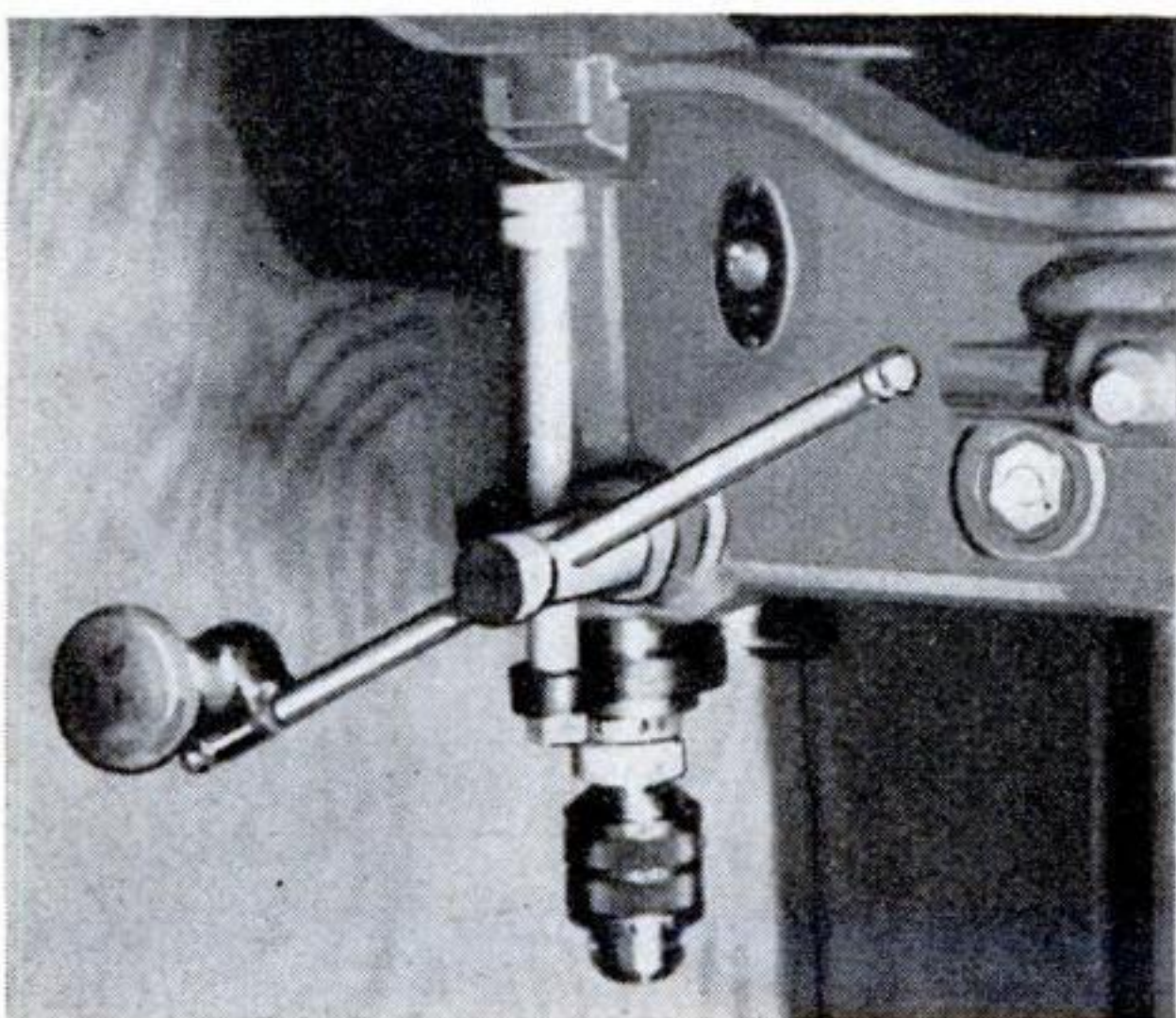


Machine Parts Cleaned with Window Sprayer

A DISCARDED window sprayer of the kind illustrated above is useful for cleaning small parts of motors and other mechanical equipment which have been disassembled for repairs. Fill the bottle with gasoline, kerosene, or any cleansing liquid preferred, and spray the parts by moving the plunger with a finger; then wipe them clean with a cloth. This equipment is also handy for removing grease and grime from the hands.—C.N.S.

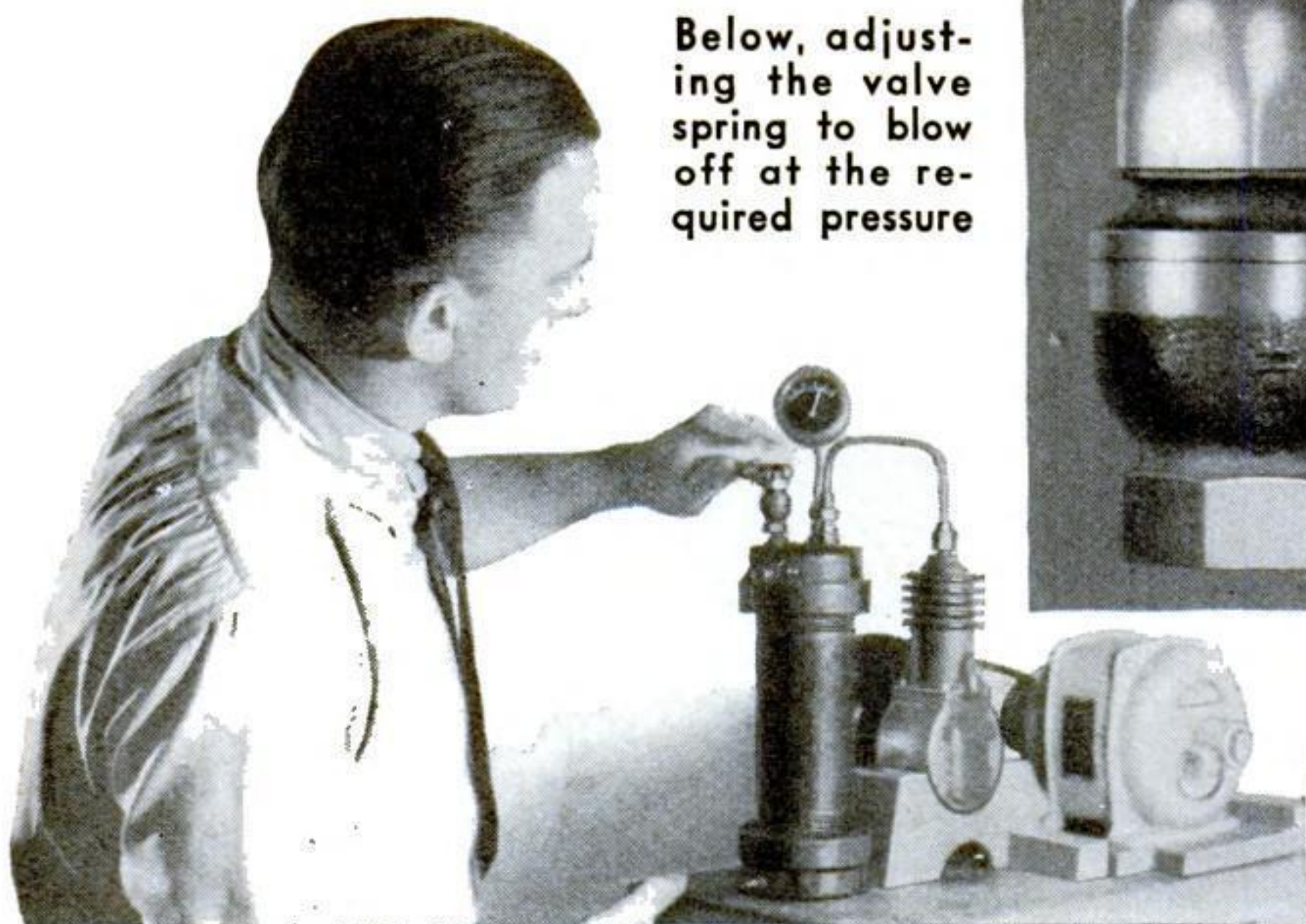
Safety Set Screw Turned Without a Wrench

SOMETIMES it is necessary to remove a safety set screw when the regular wrench has been misplaced. This can usually be done quite easily by using the end of a three-cornered file and turning the file with a pair of pliers. Find a file that is just a little loose in the set screw and grind it back to where it is a good fit in the hole.—JOHN COOK, JR.

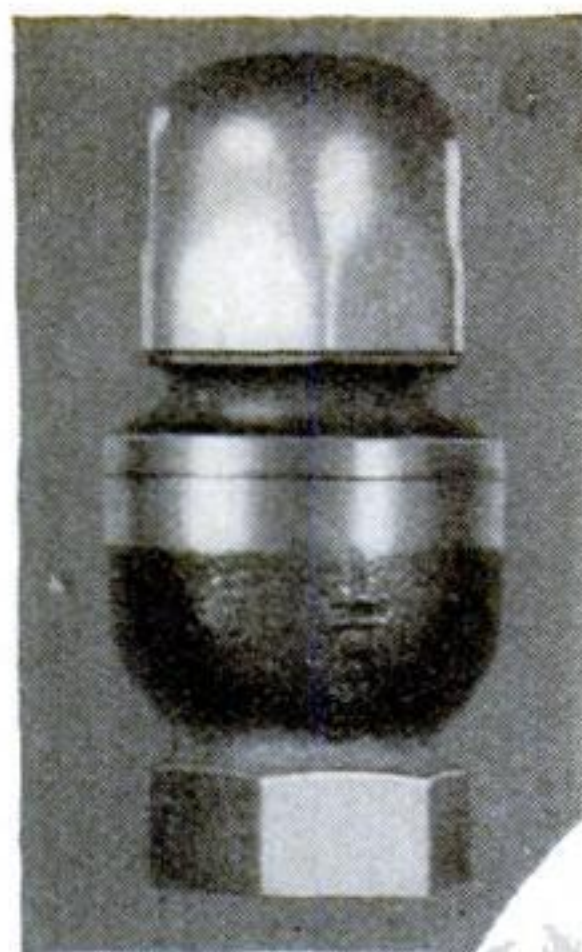


Drill-Press Feed Improved by Adding a Spinner

FOR ease and smoothness of operation, a steering-wheel spinner, obtainable at any auto-accessory counter, will improve a drill press when attached to the feed lever as shown. The operator can then drill to the full spindle-travel capacity without changing hands or altering his original grip. This idea is adaptable to drill presses with the single rod feed, as illustrated, and those with the spoke-type lever. It may be advantageous to bolt the spinner through a hole drilled in the rod if heavy metal work is to be done, but for ordinary drilling the regular friction clamp will do.



Below, adjusting the valve spring to blow off at the required pressure



Left, the complete safety valve with its aluminum cap in place. The latter is made by cutting the cover of a large paste jar

The first step in changing over the ball-check valve is to take it apart by unscrewing the cap



Small Safety Valve Improvised from a Ball-Check Valve

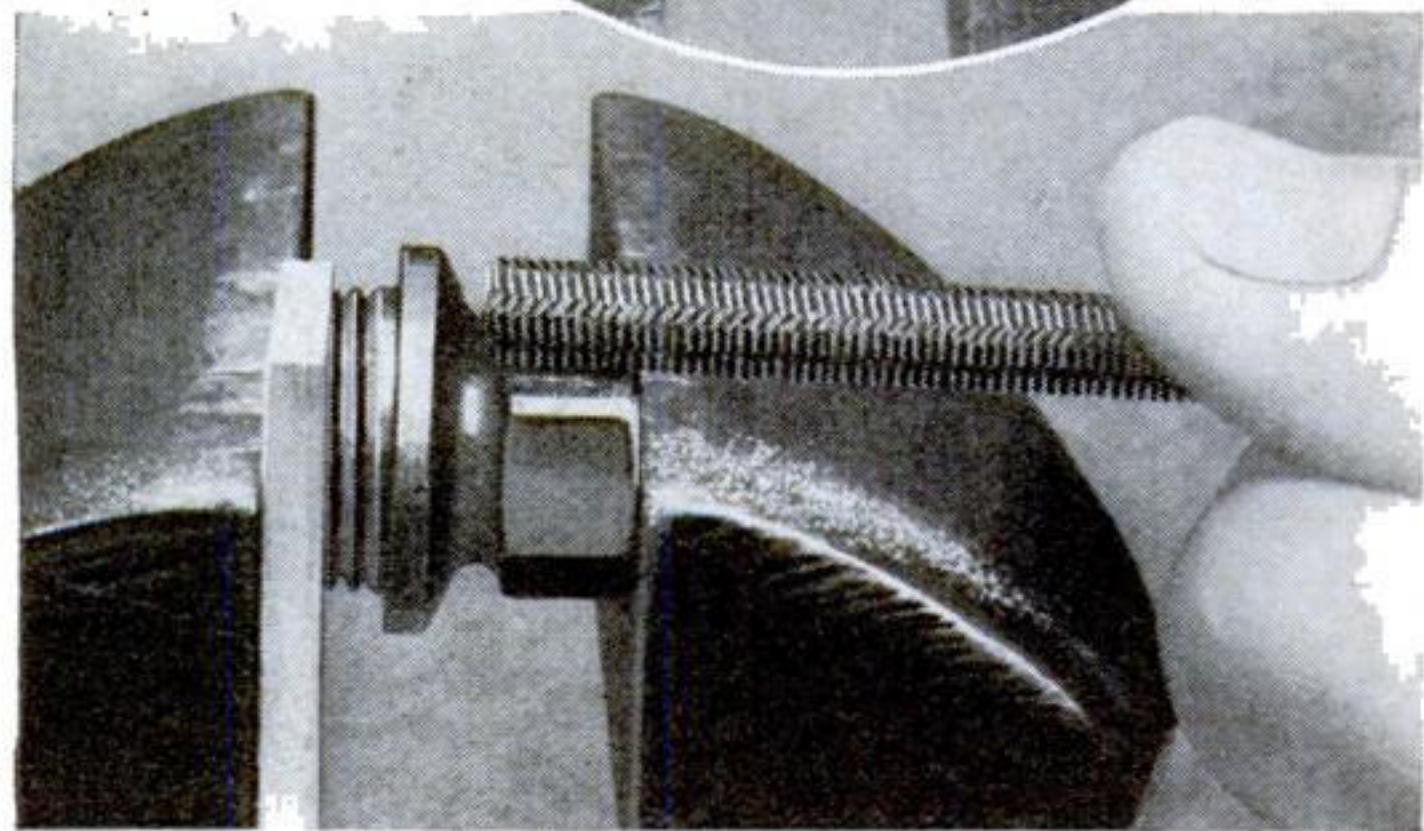
VERY small safety valves are hard to get, but one may be made from a $\frac{1}{8}$ " vertical ball-check valve. It is suitable where the pressure does not exceed 80 or 90 lb.

Unscrew the cap and set the body aside because the only changes are made in the cap. The four ball stops projecting from the inside of the cap are first removed with a small cold chisel. From the inside of the cap drill out the threaded hole to a diameter of $\frac{3}{8}$ ", leaving $\frac{1}{4}$ " of the original threaded hole.

The alternate faces of the hexagonal top are then filed as shown. This provides a vent for the extra aluminum cap.

The spring used is $\frac{11}{32}$ " in diameter, $\frac{5}{8}$ " long, and quite stiff with a nonrusting finish. The valve is reassembled with a ball in place in the body. The spring is placed on the ball, and the cap is screwed tightly into the body. Cut off a $\frac{1}{8}$ " brass close nipple $\frac{1}{8}$ " from the center and screw it into the cap so as to come in contact with the spring. It is used for pressure adjustment.

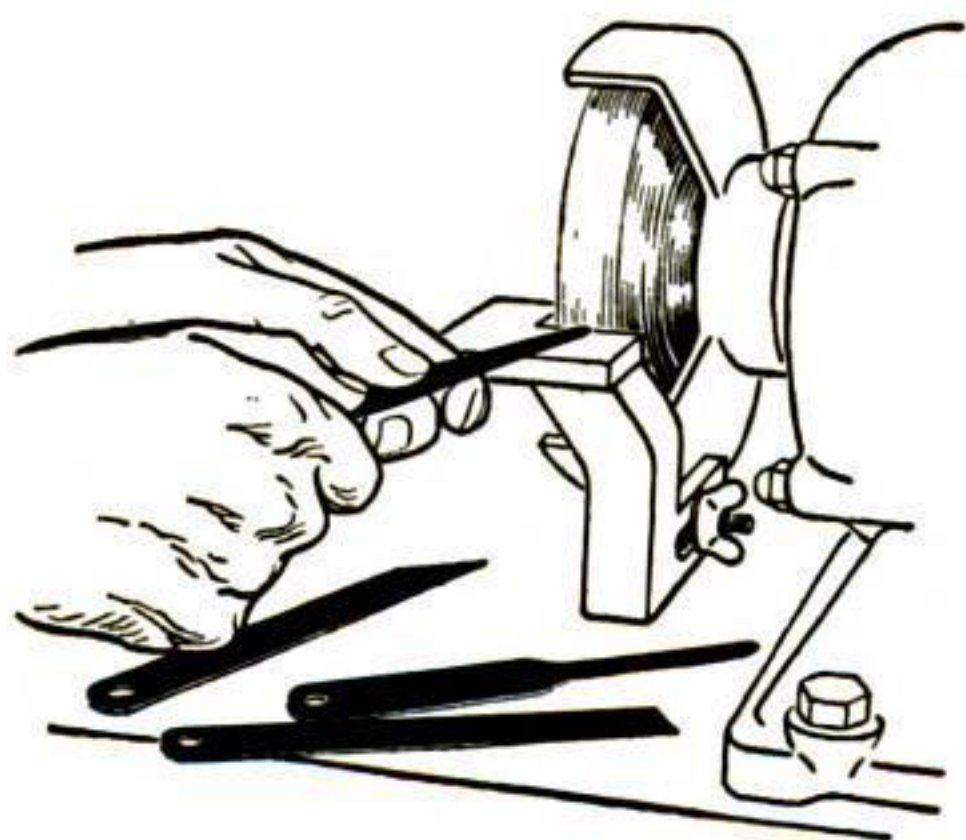
The aluminum cap comes from the cover



To provide a vent, it is necessary to file shallow grooves in alternate faces of the hexagon

of a large paste jar. Although very thin, it may easily be cut with a file by inserting a cork to back the cut. Force the cap carefully over the hexagonal top of the valve cap.

Place the valve in an air line containing a gauge, and screw the nipple against the spring until the valve blows off at the desired pressure.—D. S. GARDE.

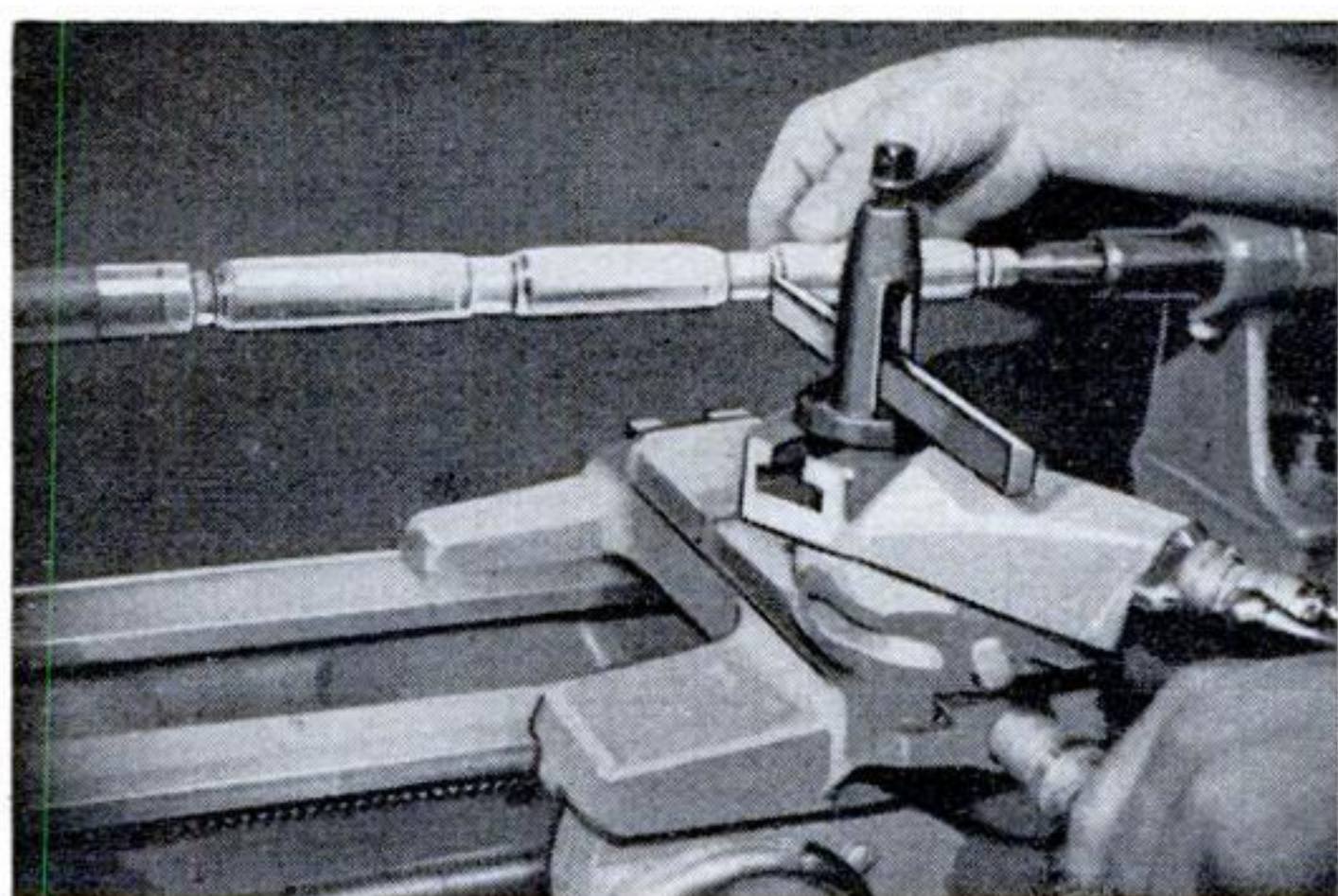


Utilizing Old Hack-Saw Blades

STICK shellac, crack fillers of various types, as well as glue and cement can often be applied to best advantage by using a flexible steel blade. For this purpose the ends of discarded or broken hack-saw blades may be ground to suitable shapes. The steel used in these blades is generally hard enough to withstand the heat necessary to apply those fillers which have to be melted, such as stick shellac and black wax, without becoming too soft. The teeth should be ground off, but leave on the rounded end with the hole as this enables the tools to be hung up.—WARREN CRANE.

Handy Brushes for Gluing and Touch-Up Jobs

SMALL brushes for touch-up jobs or applying glue or soldering acid may be made from tufts of bristles taken from an old clothes or shoe brush. Glue them into holes drilled in short lengths of dowels. Use case-in glue, which is waterproof when dry; the brushes will then resist alcohol, turpentine, and even mild acid. They are so cheap and easy to make that they may be discarded after being used. This saves time in the long run because it does away with the always messy job of cleaning.—W. C.



Extra Tool Handles Turned from Broomsticks

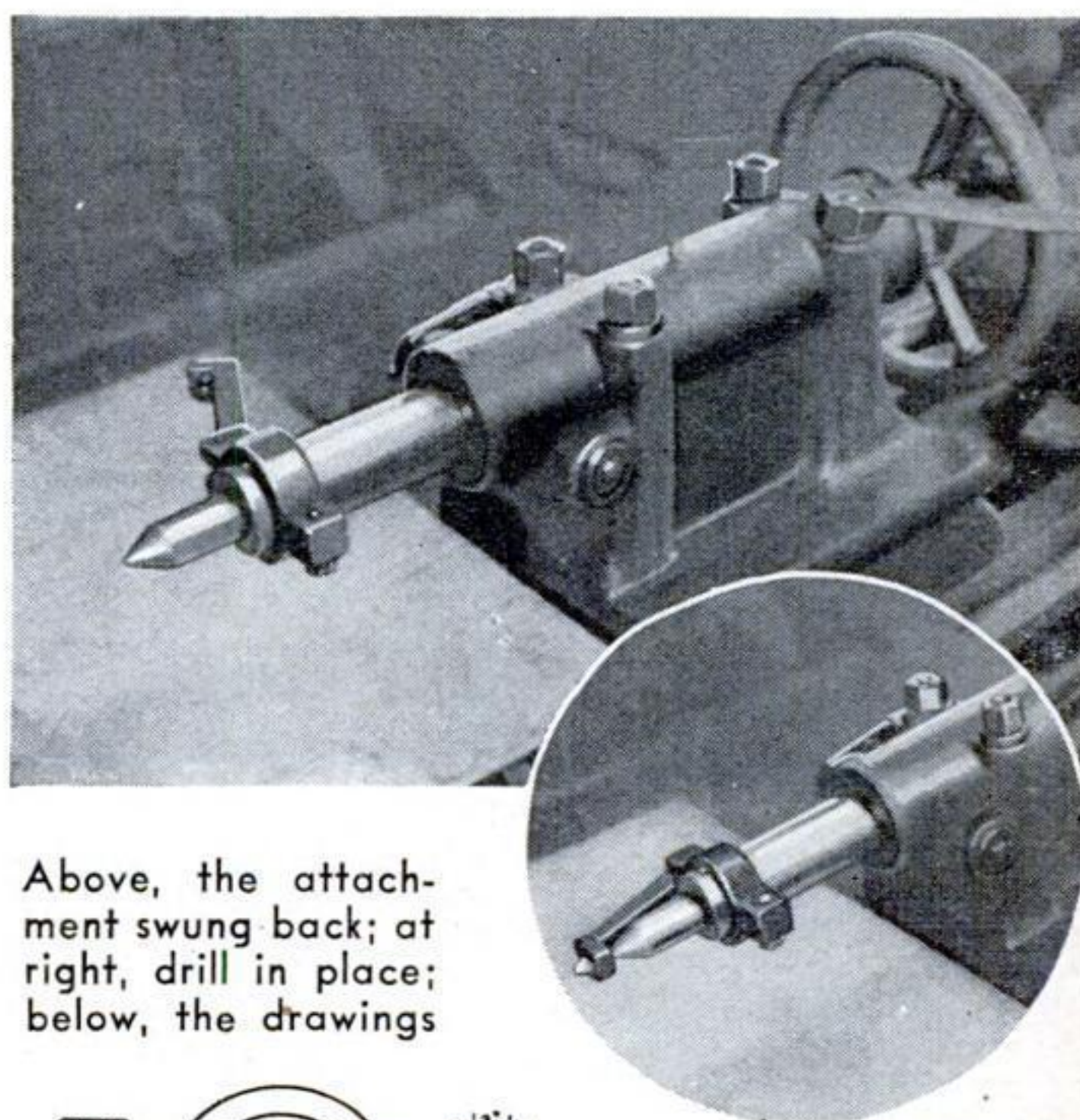
BY UTILIZING discarded hardwood broomsticks, you can stock a supply of small tool handles to take care of any needs. My method is to center the stick and hold it with a dog just as if it were a piece of cold-rolled steel. The turning is done, not with wood-turning tools, but with a plain cut-off tool with plenty of rake on all cutting surfaces. The handles are made in gangs of three as illustrated above. The method of making them follows: 1. Take light cut across desired length to obtain concentricity. 2. Recess the handles for individual length. 3. Turn necks to a drive fit for ferrules. 4. Rough ends to desired forms with compound rest and finish with sandpaper. 5. Saw off, drive ferrules, and drill. Ferrules can be made from pipe or tubing.—THOMAS RETA.

Thick Lather Removes India Ink

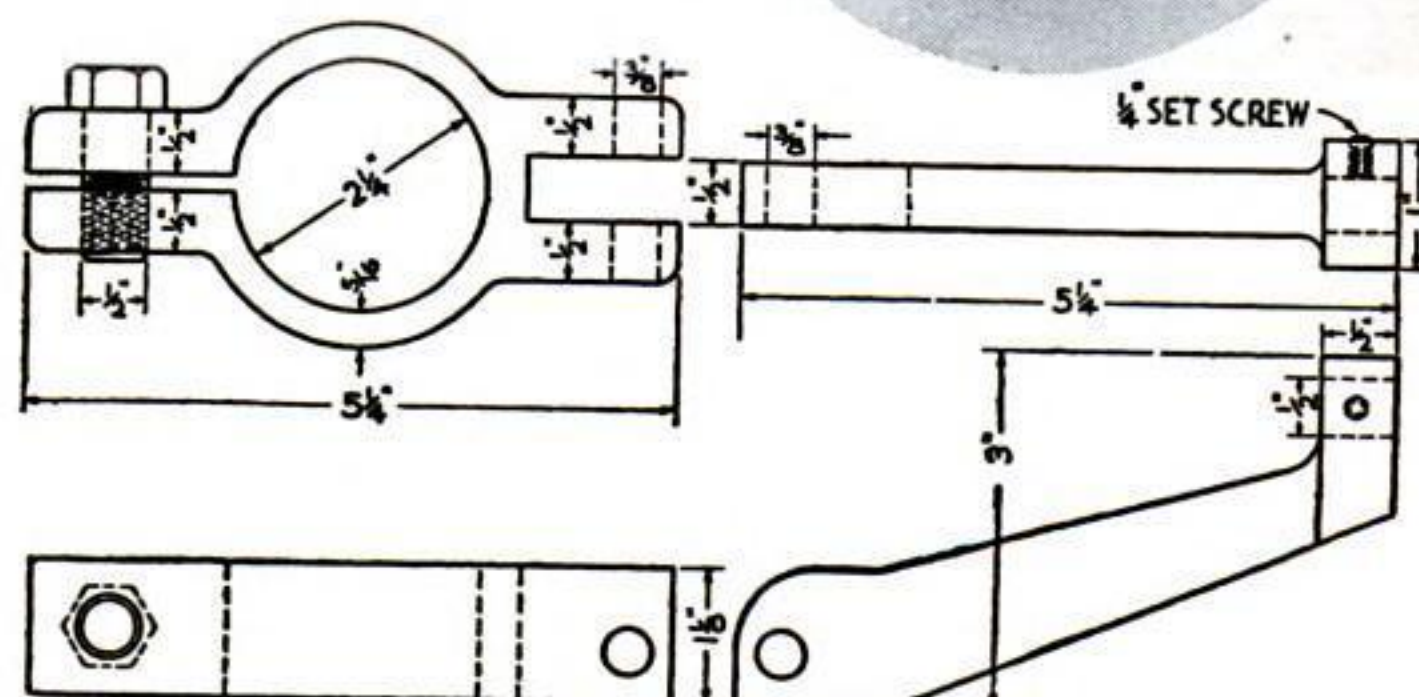
IF INDIA drawing ink is spilled on cloth or clothing, it usually can be removed by rubbing a thick lather of soap into and around the spot, but this must be done while the ink is still wet.—L. E. R.

Quick-Acting Center Drill Speeds Up Lathe Work

PRODUCTION on the lathe may be speeded up by mounting a centering drill on a bracket as illustrated below so that it may be used without removing the regular tailstock center. The bracket that holds the drill is hinged to a clamp on the tailstock spindle in such a way that it can be swung back out of the way as soon as the work has been center drilled.—GEORGE S. WALKER.



Above, the attachment swung back; at right, drill in place; below, the drawings





Magnetic Compass Shows Location of Plastered-Up Outlet Box

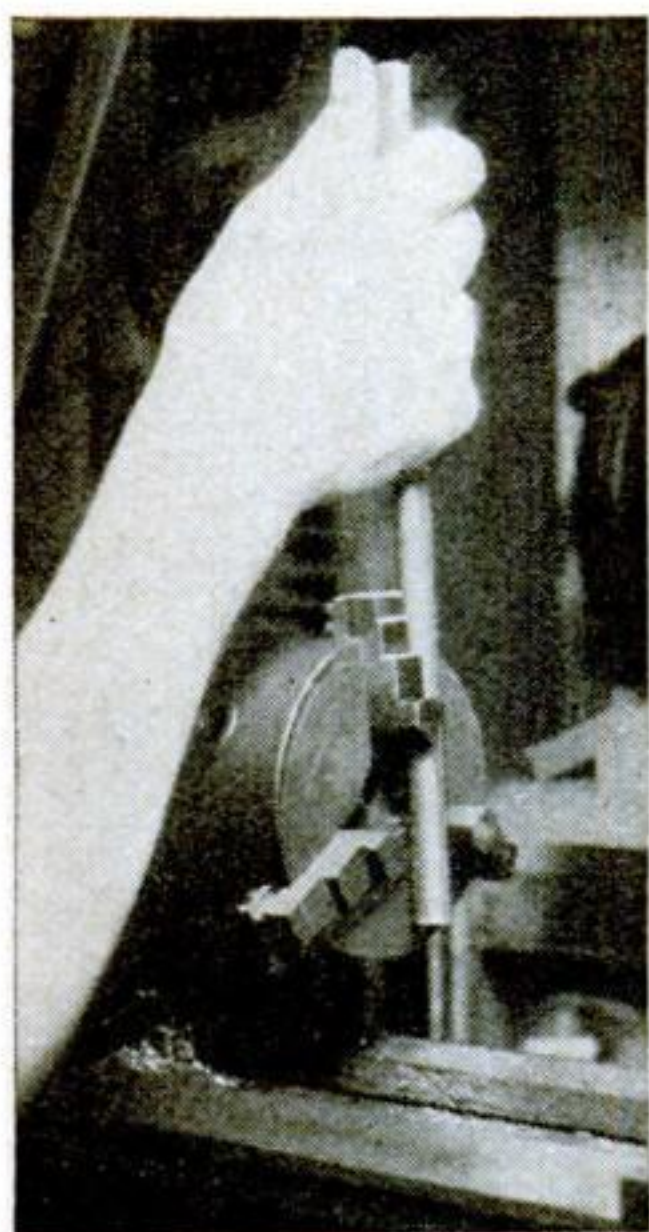
IN NEW buildings, a careless plasterer will sometimes cover up an electrical switch or outlet box, and this may not be noticed until after the finishing has been done. To locate such a box requires considerable time and occasionally is almost impossible to do. It can be found, however, by placing the edge of a magnetic compass against the wall where the box is supposed to be and moving it along until the needle swings to point to a definite spot on the wall. The iron box is sufficient to cause this deflection, and when the plaster is chipped out at this point, the box will be uncovered.—ROBERT K. URIE.

The hidden box is indicated by the deflection of the needle

Lathe Chucks Unscrewed by Using Brass Bar

FROM time to time various authorities advocate using a hardwood block on the back V-way and a backward rotation of the spindle

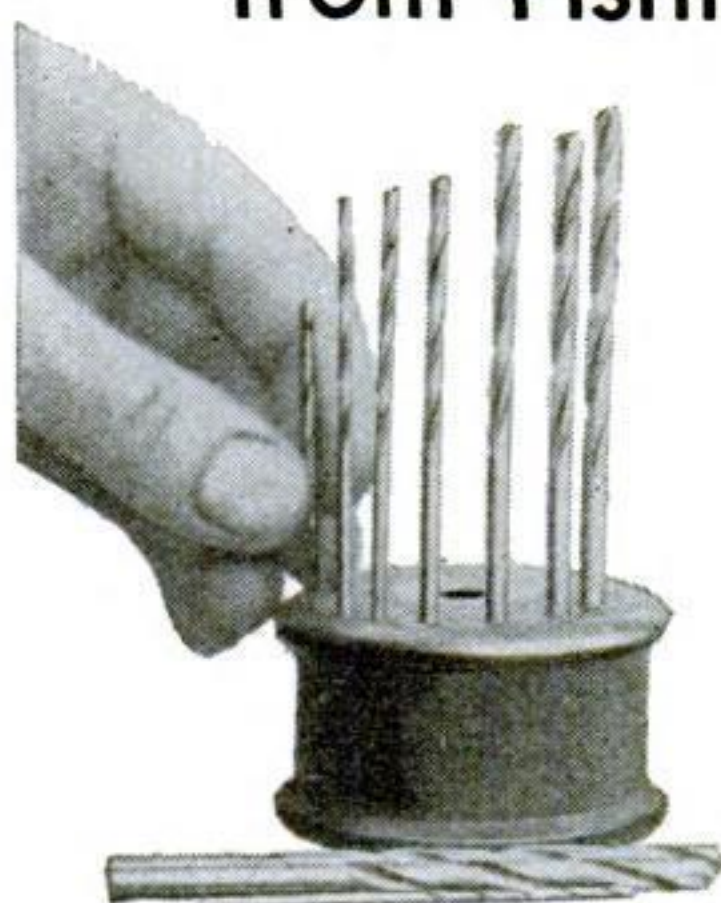
to remove a frozen chuck or faceplate from a lathe. Since this method involves a definite hammer blow when the jaw strikes the block, I prefer to use a round brass rod as illustrated. It is necessary, of course, to lock the spindle against rotation by engaging the back gears without releasing the bull-gear plunger. To remove a faceplate, screw a couple of studs into it to act as bearings.—R. T. TILDEN.



Extended Edge Improves Small Drawing Board

LINES can be drawn with greater accuracy on a small drawing board near the top and bottom of the paper if an auxiliary edge is added to the board as illustrated at the right. The edge is a piece of pine the same thickness as the drawing board, about 2" wide, and 10" longer than the board is wide. It is fastened with corner braces so as to protrude 4" at the top of the board and 6" at the bottom.—LAWRENCE SUESS.

Small Drill Holder Made from Fishline Spool

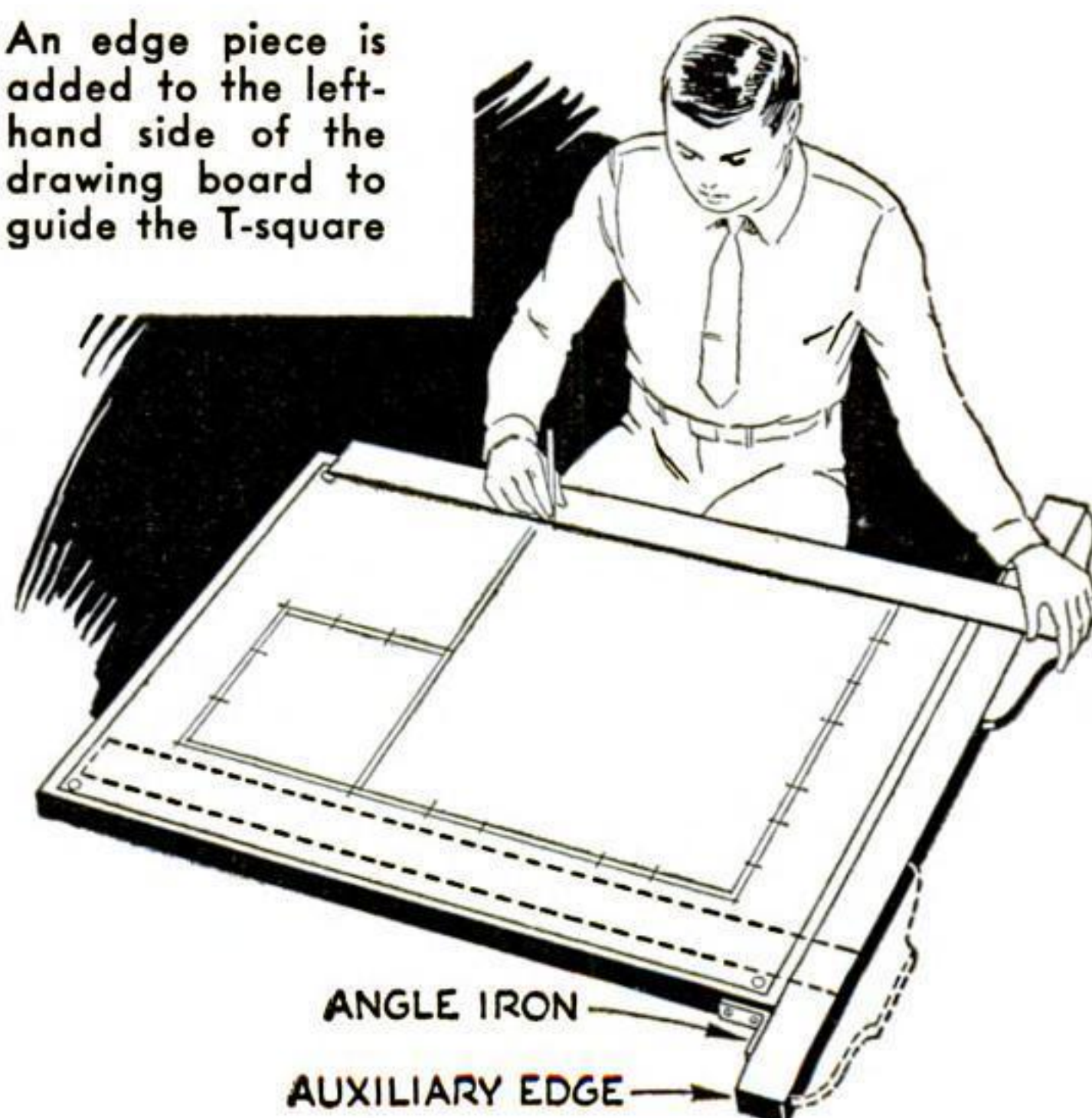


Holes are drilled in the fishline spool to hold a number of small twist drills

MANY types of holders for small drills are in use, and the beautifully finished metal stands sold for the purpose cannot, of course, be surpassed. Nevertheless, for ordinary bench use, it is hard to beat an empty fishline spool. The wood is quite tough and hard, and the shoulders give a good grip when the block is picked up.

The spools are of a sufficient size to afford a firm base, and a circle of holes can be drilled to accommodate a good many small drills.

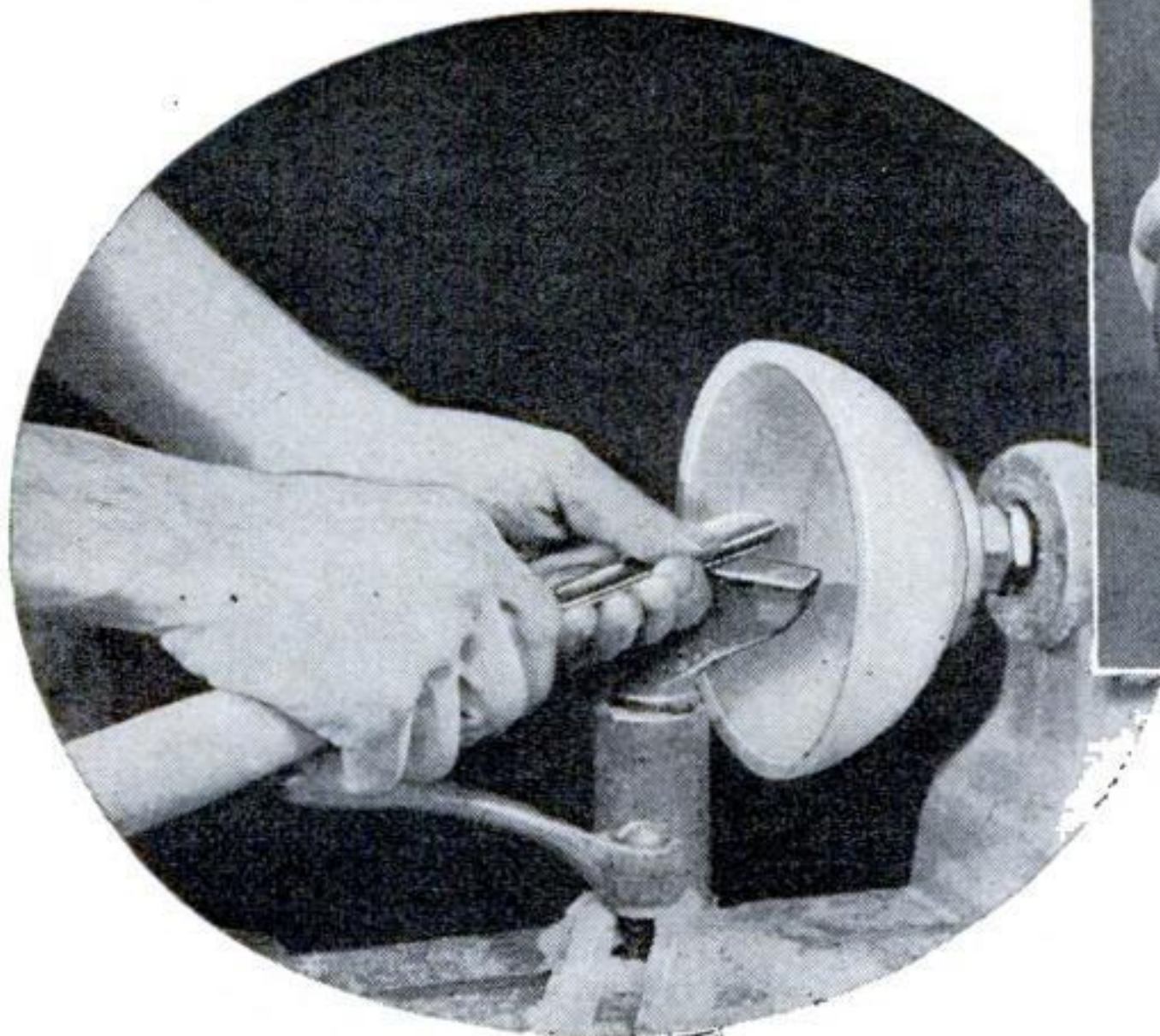
An edge piece is added to the left-hand side of the drawing board to guide the T-square



ANGLE IRON
AUXILIARY EDGE

Candy Bowl

LOOKS AS IF CARVED
FROM A BALL

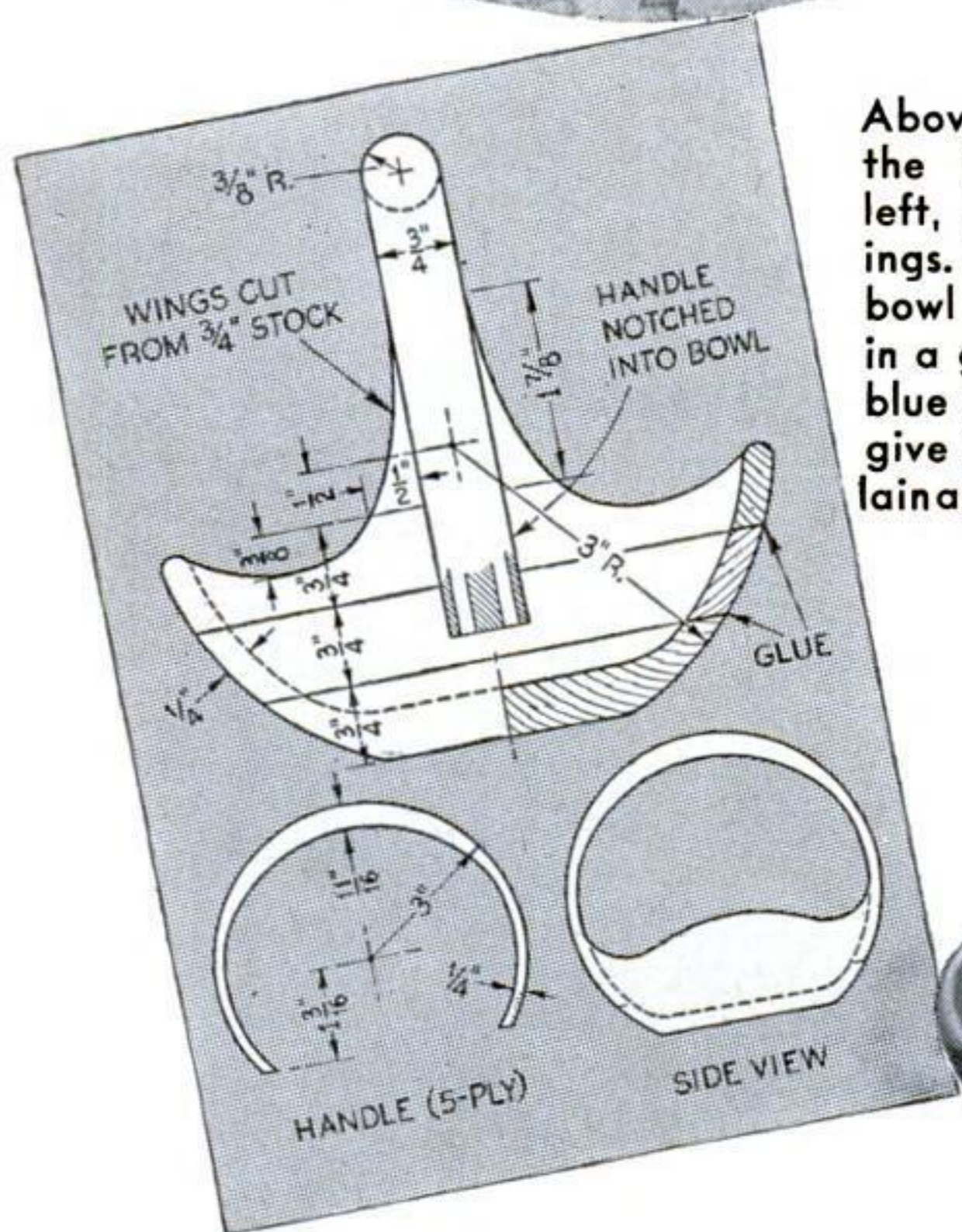


FINISHED in bright blue enamel, this candy bowl looks as if it had been shaped from a sphere 6" in diameter and resembles a colorful bit of pottery. Actually it is built up of wood.

The rough stock consists of three disks of 1" wood glued together after the manner of lifts for a ship-model hull. Screw the block to a faceplate and turn the bowl to shape. A template cut from cardboard will help in keeping the outside true to the circle. After sanding the bowl, saw out the handle notches and rough out the scallops at each side.

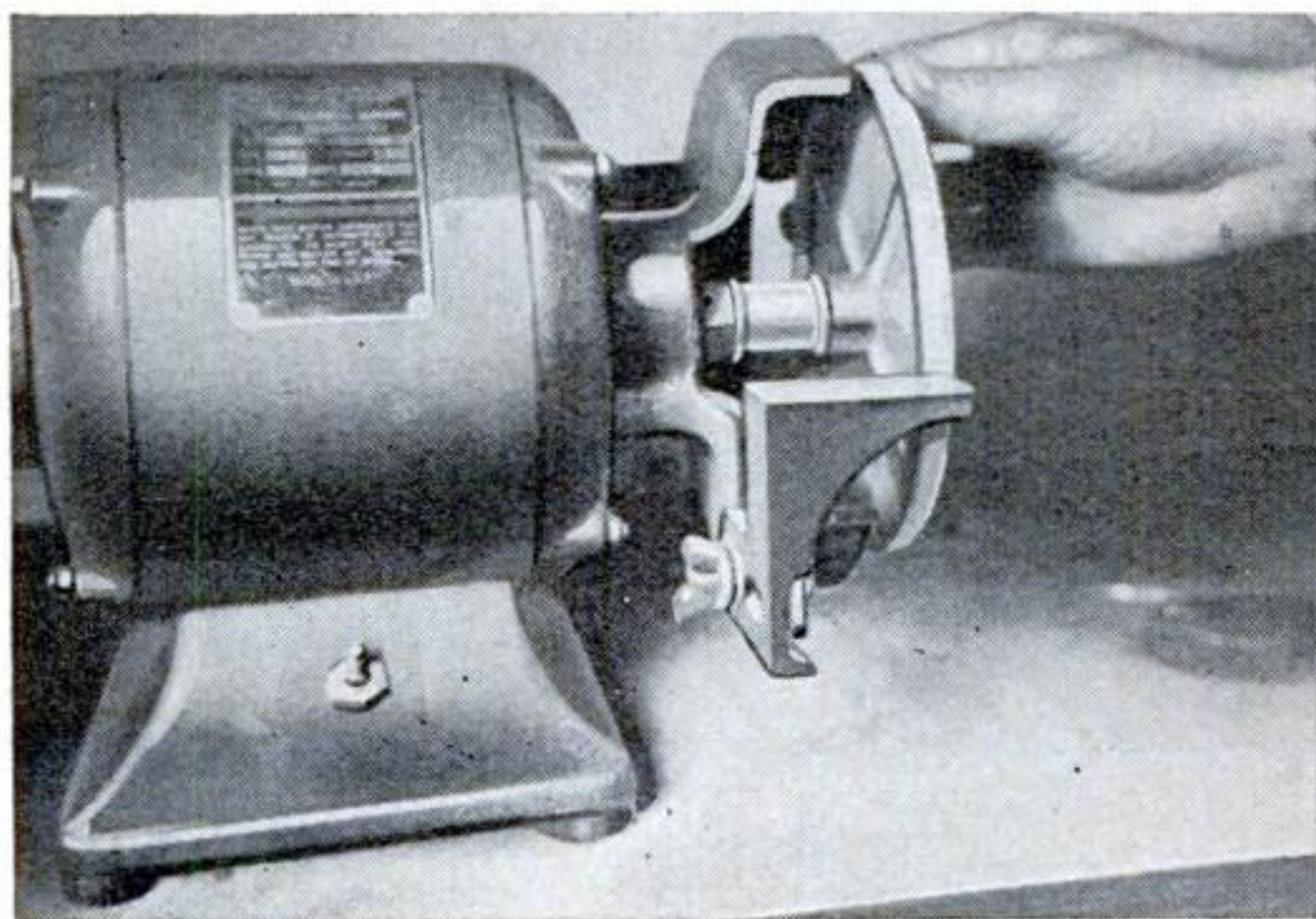
Saw the handle from five-ply wood and glue the ends into the notches. They can be sprung in or out, as necessary, to bring them flush with the bowl, and held temporarily in position with brads. Make four wedge-shaped wings to glue in place on each side of the handle where it enters the bowl. These are carved as continuations of the bowl edges, forming an unbroken curve up the handle. Sand the entire bowl thoroughly before enameling it.—L. K.

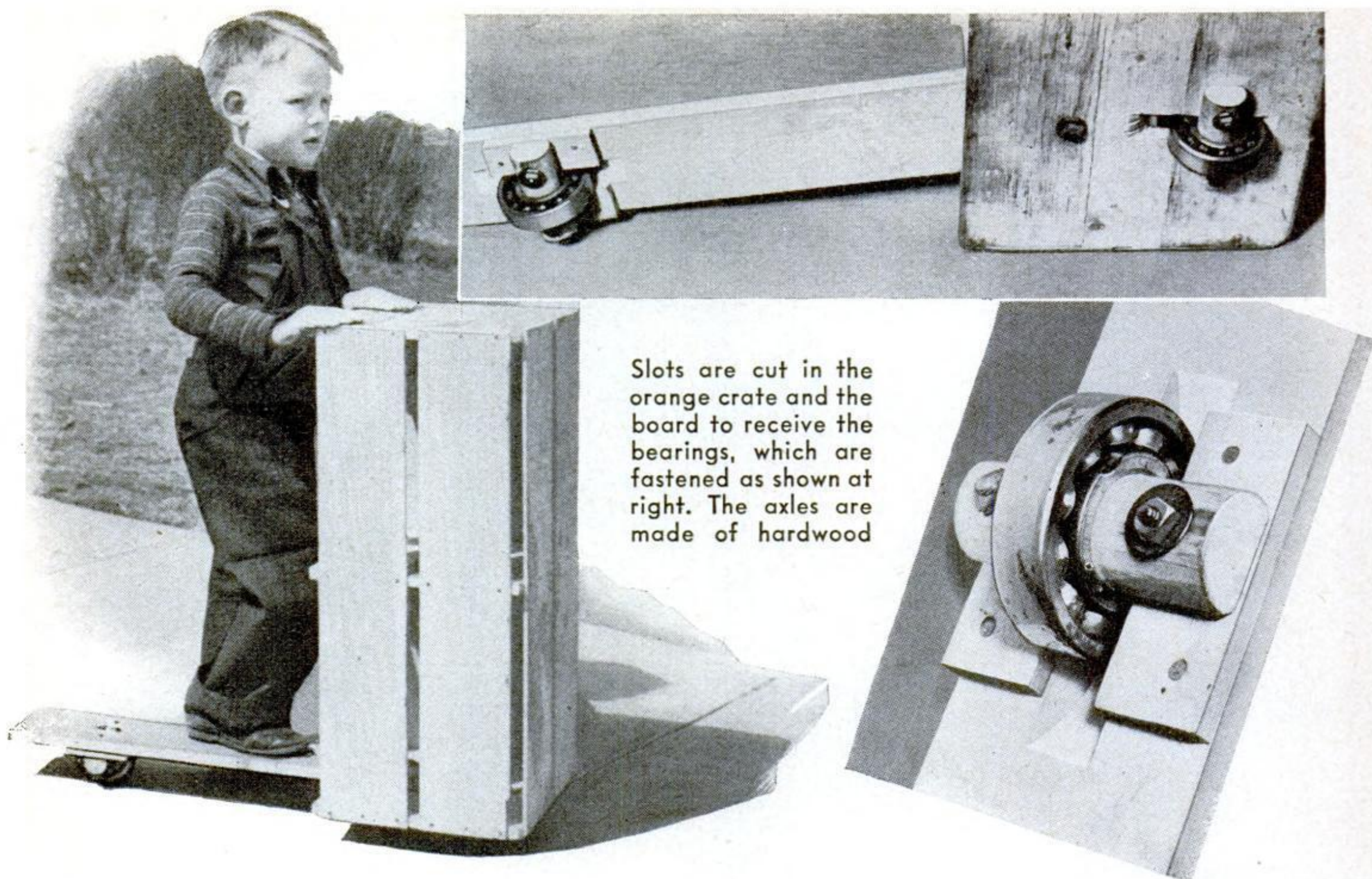
Above, turning the inside. At left, the drawings. Below, the bowl is finished in a glossy, rich blue enamel to give it a porcelain appearance



Spool Serves as Spacer for a Sanding Disk

AN ORDINARY wooden thread spool, if bored out to suit the motor shaft, makes a good spacer for mounting a sanding disk or other accessories on a grinder. Such a spacer is especially necessary with the common type of sanding disk that has a threaded hole through the center, because sometimes heavy pressure against the abrasive surface causes the disk to slow down and the end of the motor shaft to run out through the sheet.





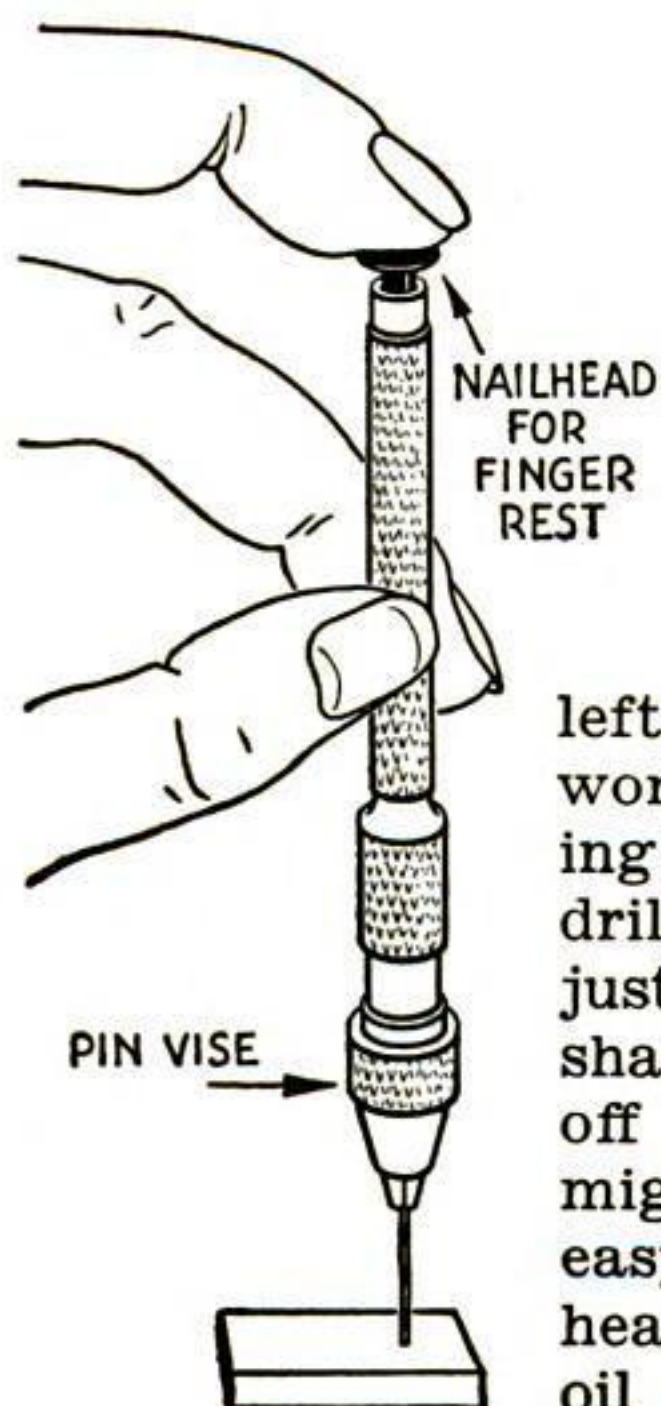
Slots are cut in the orange crate and the board to receive the bearings, which are fastened as shown at right. The axles are made of hardwood

Orange-Crate Scooter Has Ball-Bearing Wheels

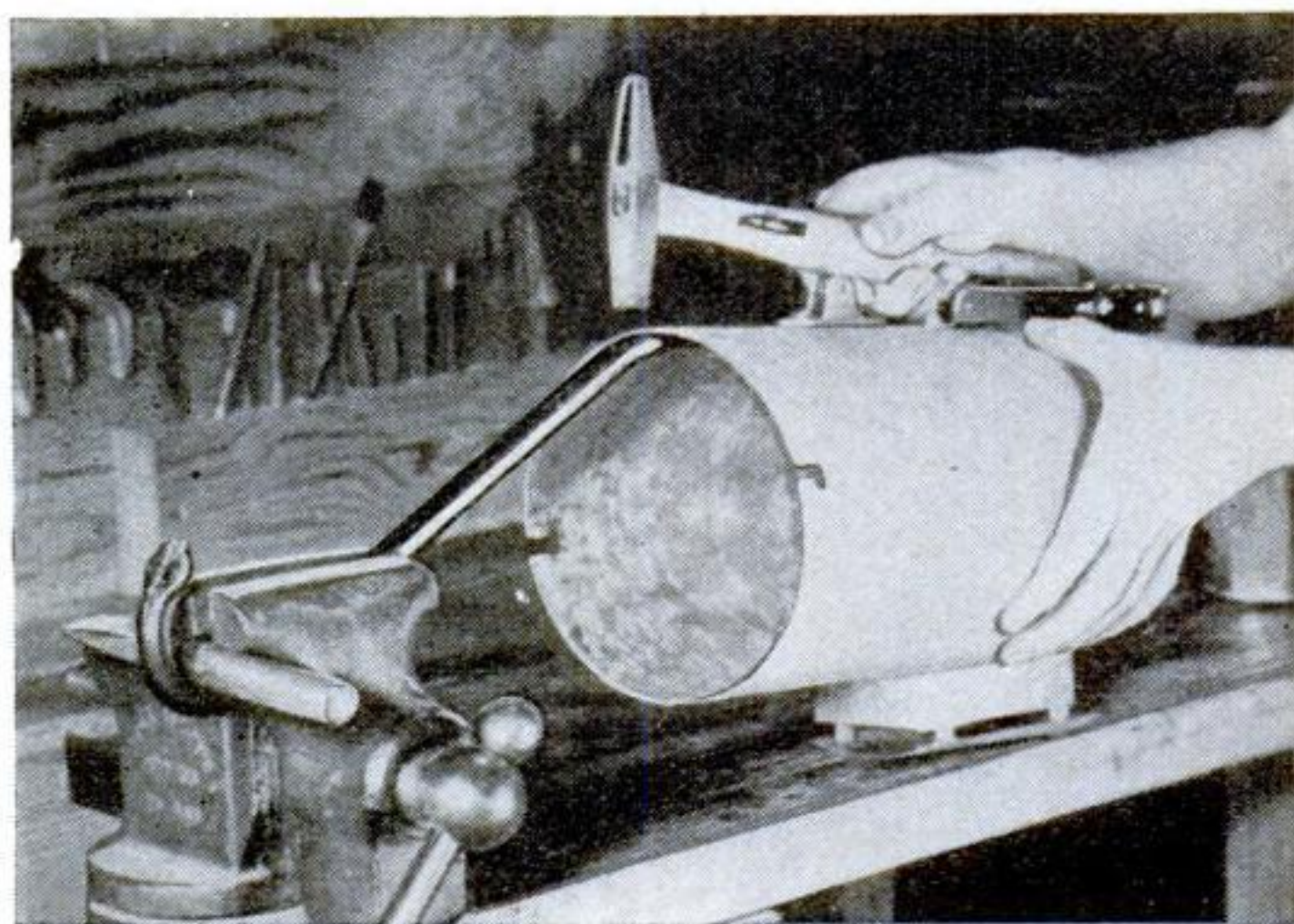
OLD ball bearings from the rear axle of an automobile serve as the wheels of this speedy scooter. It is made from an orange crate and a piece of board 4" by 24". A slot is sawed in one end of the orange crate and another near the end of the board to receive the ball-bearing wheels. The axles

are cut from hardwood and forced into the inner ball race; and one side is flattened to fit against the boards, to which they are fastened with $\frac{1}{4}$ " bolts. The board should be pivoted to the orange crate with a $\frac{3}{8}$ " bolt. The wood is faced at this point with two pieces of sheet iron to form a bearing.

Finger Rest for Pin Vise



IN MUCH delicate bench work such as ship model making and other types of model construction, a pin vise is in almost constant use for drilling very small holes. The ordinary type of pin vise, such as that shown at the left, can be improved for work of this kind by adding a finger rest to aid in drilling. Select a nail that just fits into the hole in the shank of the vise and file off any roughness that might interfere with the easy operation from the head of the nail. A drop of oil will improve the action.



Extra Long Riveting Stake

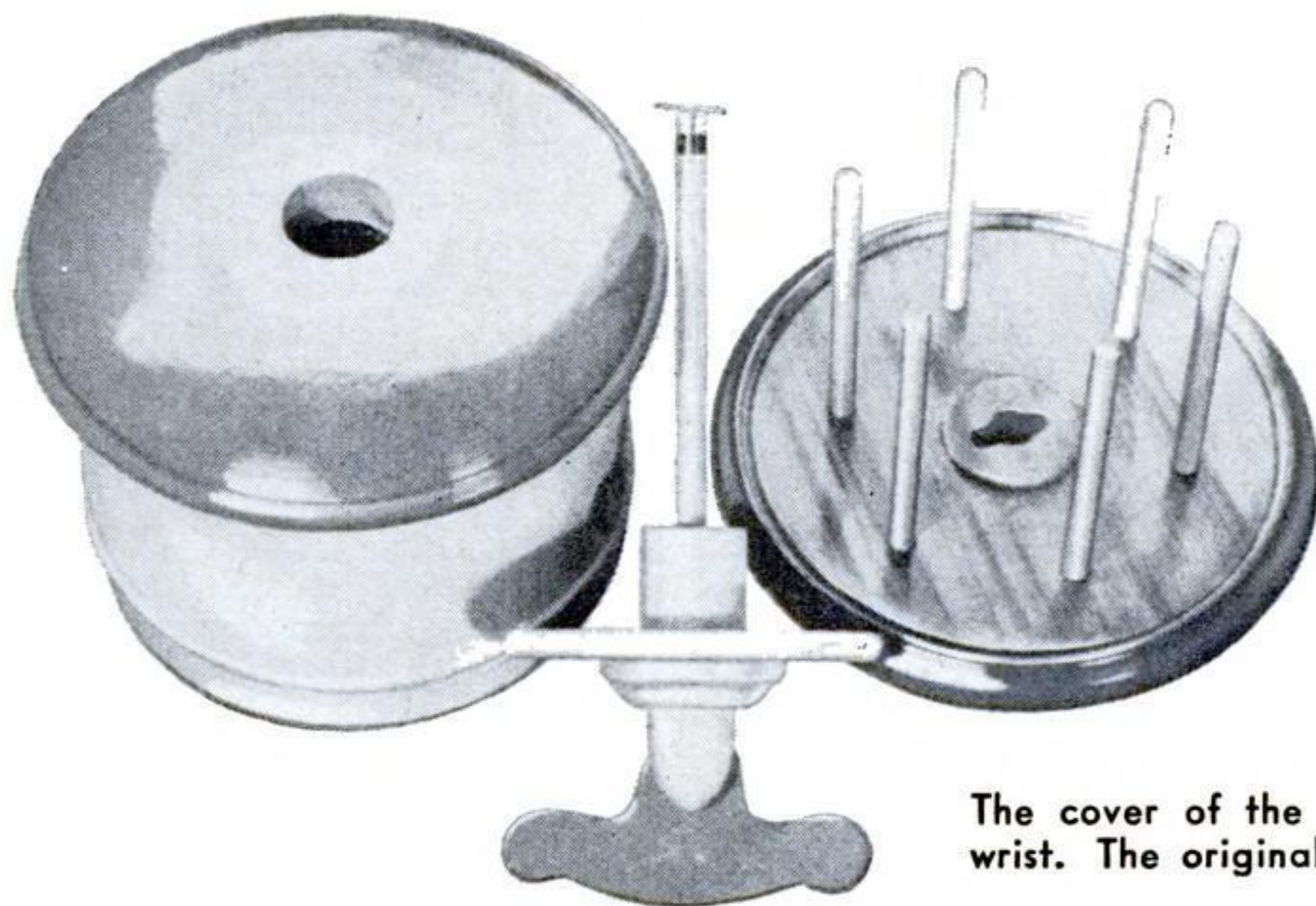
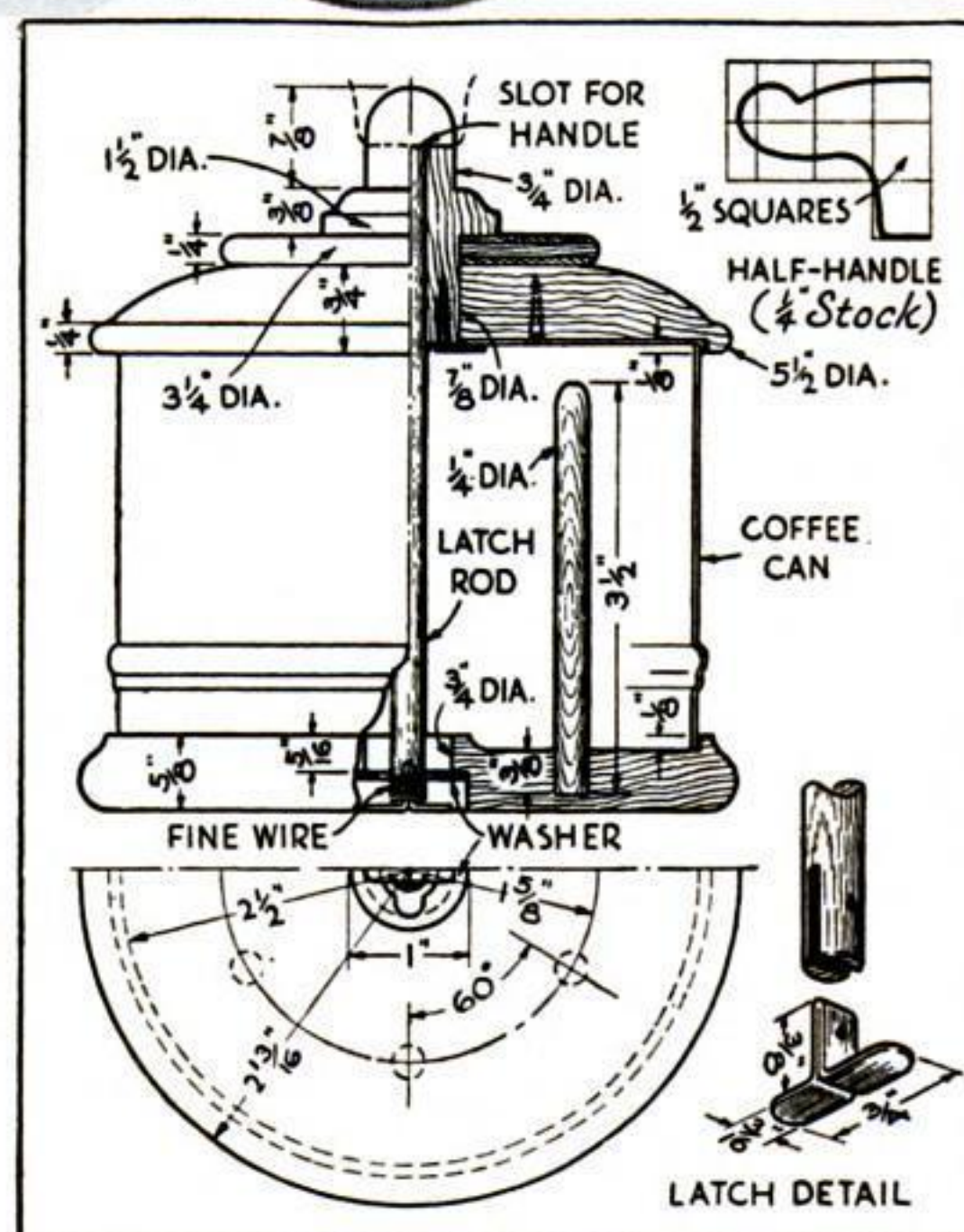
A BENCH stake for riveting and other work on awkwardly shaped parts may be improvised by clamping a wrecking bar in the vise. To prevent the U-shaped end of the bar from shifting, a cold chisel should be placed as illustrated.—R. W.

Twelve Spools of Thread Held in Neat Container

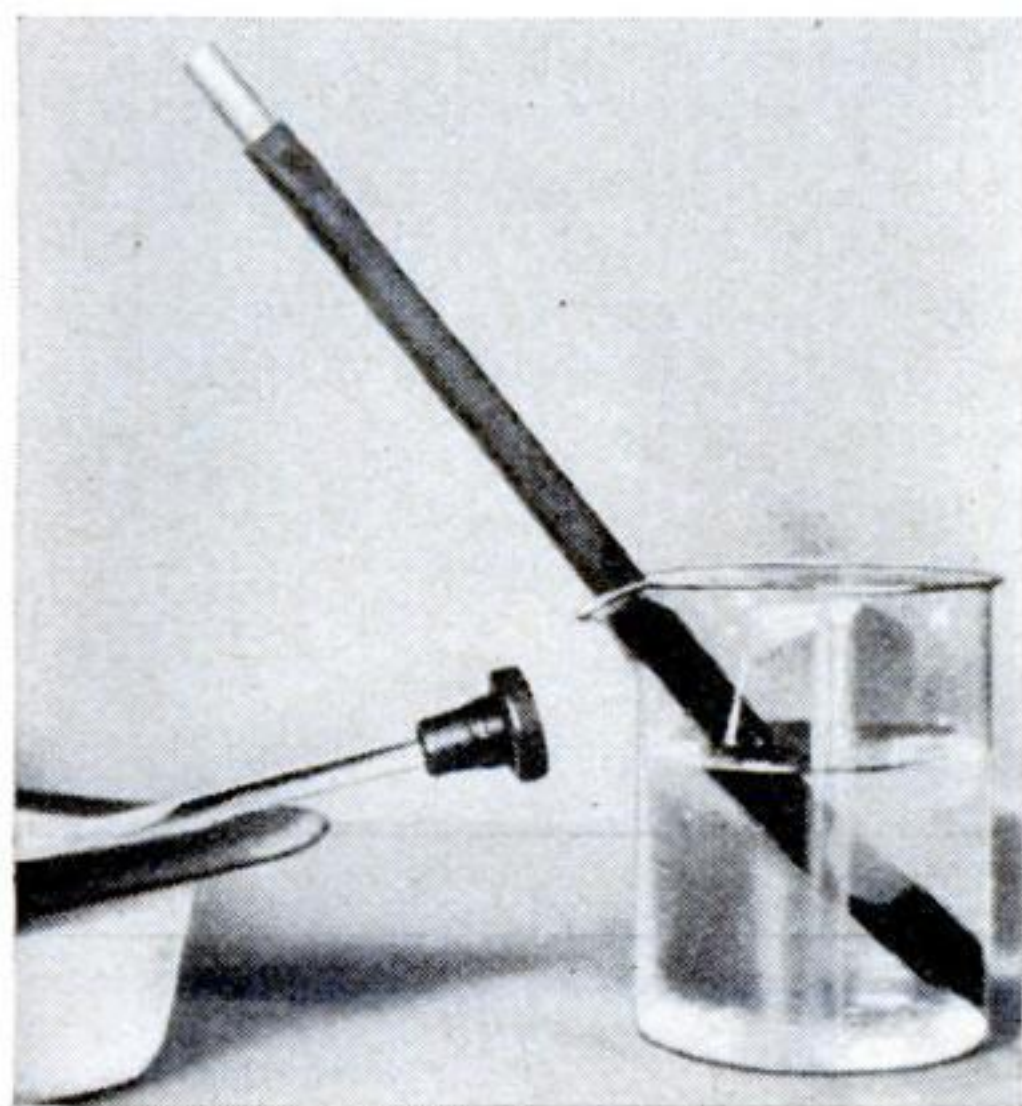
UP TO a dozen spools of thread may be kept in this neat spool holder. The cover is fitted with a revolving catch.

Mount a disk of 1" stock on a faceplate and recess the front as indicated, leaving a raised table in the center for the latching mechanism. Turn the rim large enough to give clearance for the coffee-can edge after painting. Bore the center recess and the six peg holes.

Turn the lid and screw it to the can bottom. The handle pivot must turn freely in the hole, and is slotted for the handle. The latch-rod catch, bent from stiff metal, is held with a through-pin and a binding of fine wire. Cut slots in the bottom center hole to admit the catch, and insert a washer filed to correspond, to take the wear. Insert the handle pivot in the lid and screw a retaining washer on the lower end.



The cover of the spool holder locks by a twist of the wrist. The original was painted yellow and sage green



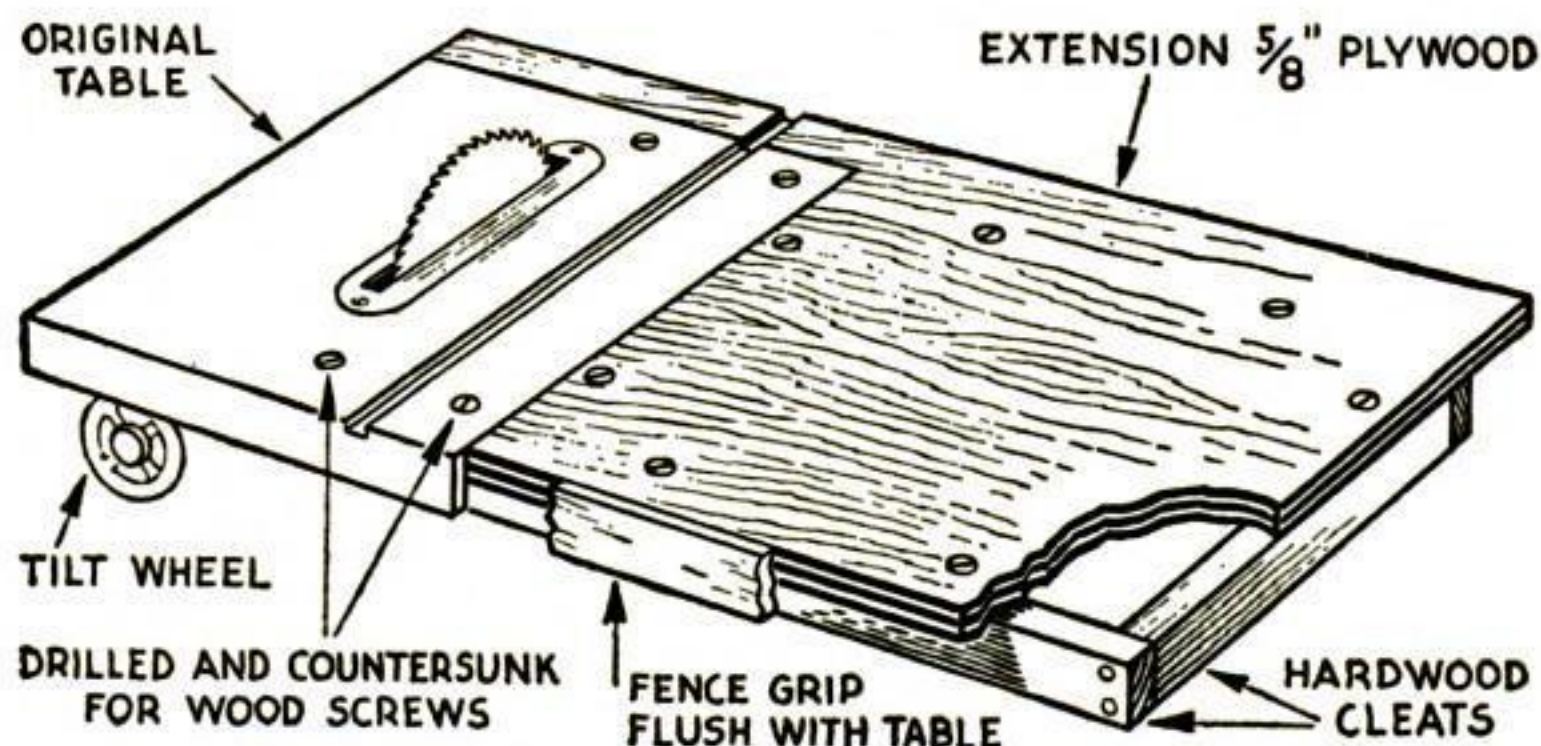
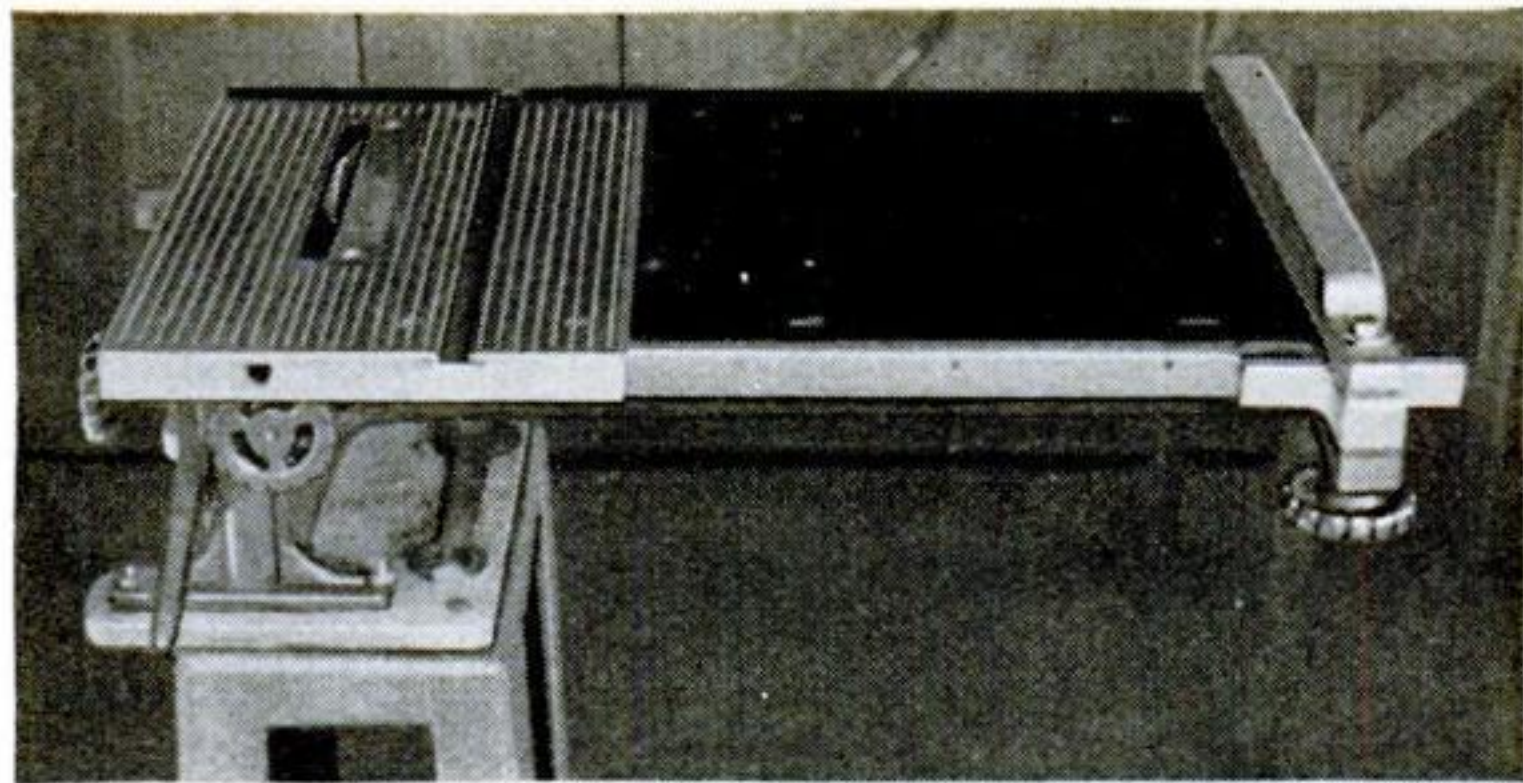
An Unbreakable Rod for Stirring Photographic Chemicals

GLASS stirring rods have to be handled very carefully, but an unbreakable rod for photographic use may be made by covering a piece of $\frac{1}{4}$ " wooden dowel with high-grade rubber tubing. Let the tubing extend for $\frac{1}{2}$ " at one end. Wash this end out with turpentine, fill it with rubber cement, and let it dry. It may then be clamped together to form a flexible scraper. Separate rods should be made for the developing and fixing baths. The rubber is impervious to all but strong acids and caustic alkalis.

When a glass stirring rod is used, it may be improved by slipping the stopper from a bottle of tincture of iodine on the end. This aids in stirring and crushing.—N. S.

Clothesline Props Hang Neatly on Garage Wall

CLOTHESLINE props will stay clean and last longer if they are hung up when not in use on long brass screws driven into the outside wall of the garage, or on nails inside the garage if the height is sufficient. Keep the props well painted.—J. L. D.



Plywood Extension Improves Small Circular Saw Table

MANY small home workshop circular saws of the type illustrated above can be made more serviceable for large work by adding a home-made extension table. The extension shown was constructed from the plywood lower shelf of a discarded tea wagon. Cleats were added as indicated in the drawing so that it could be fastened with countersunk wood screws to the original saw table. It is important, of course, that the joining edges be flush and true and that the extension be absolutely level.—H. S.

OIL STAINS

[PAINTING]

Standard oil stains may be mixed and applied to wood as follows:

1. For the liquid vehicle, mix 1 part benzol, 1 part turpentine, $\frac{1}{4}$ part four-hour varnish, and 2 parts gasoline.

2. Weigh out 2 oz. of oil-soluble aniline stain powder in a clean vegetable can. (If a stronger stock solution is desired, use 4 oz.)

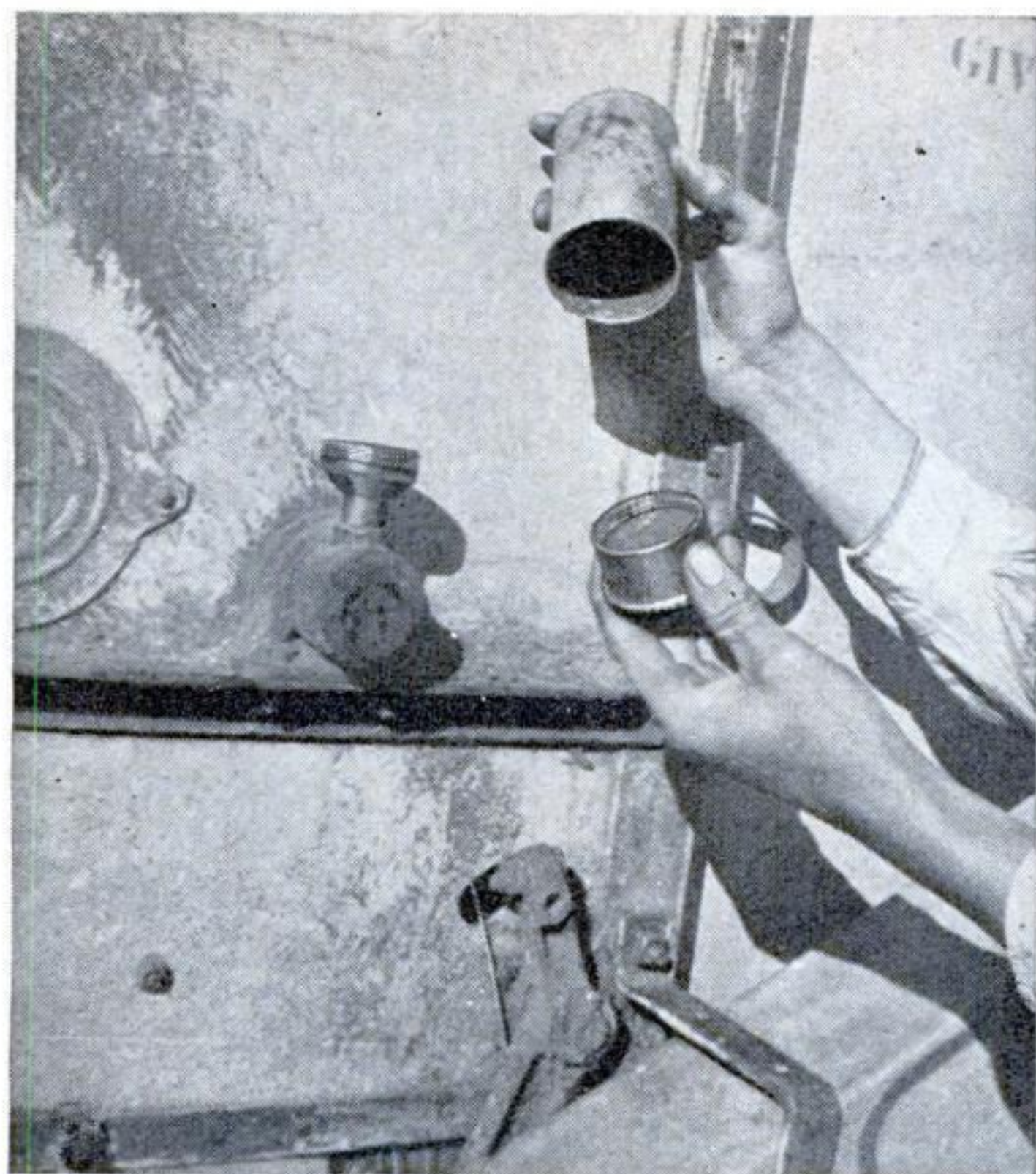
3. Immerse the can in hot water away from any flame, and fill the can two thirds full with the solvent. Stir

this to a paste, then transfer to a suitable 1-gal. container and fill with solvent to make 1 gal. Let stand twenty-four hours. Stir well before using.

4. Apply to well-sanded wood with a 3X black China bristle brush. Wipe with rags to an even shade; or if a high-light effect is desired, wipe off lighter in the proper places.

5. Dry twenty-four hours in a warm room before finishing.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



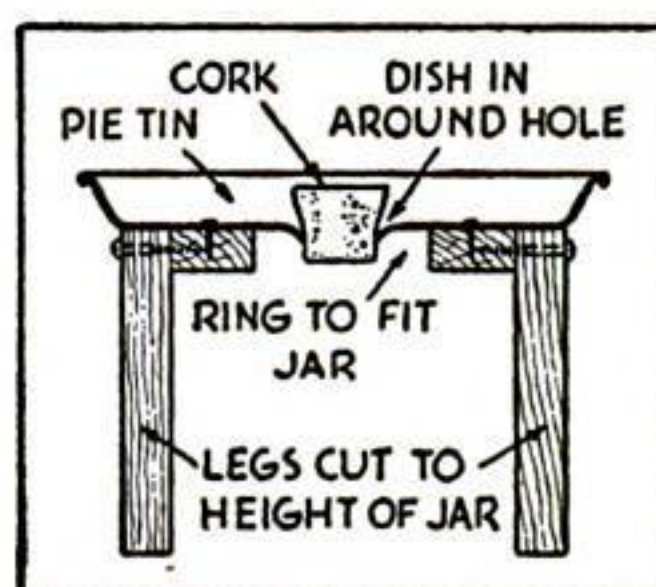
Keeping Chaff from Grease Cups of a Threshing Machine

WHEN grease cups are being filled around a threshing machine, dust and chaff get into the grease left exposed in the bottom part of the cup. This can be prevented, as shown above, by covering the exposed part with a tin can from which the top has been removed.—N. W.

Sharpening saws properly involves many problems, and the data sheet below is the first in a series that will cover the subject.

Hardware Sorting Tray for Use with Jars

IF SCREWS, bolts, washers, and other hardware are kept in glass jars, it pays to make a sorting tray on legs like the one illustrated below. The contents of a jar can be poured into the tray for selecting the required part. The empty jar is then placed under the tray, the cork pulled out, and the unwanted parts are scraped back into the jar through the hole. The tray is merely an 8" diameter pie tin mounted on a ring cut from $\frac{3}{4}$ " wood and raised to the height of the jars on four legs. A hole about $1\frac{1}{2}$ " in diameter should be cut in the bottom.—J. S. BOREN.



HANDSAWS—JOINTING AND SHAPING

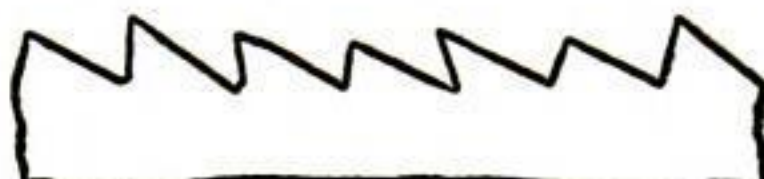
[WOODWORKING]

Joint a rip saw or crosscut saw by running a flat mill file or a saw jointer back and forth over the teeth until every one has been touched. Shaping is necessary only when the teeth are very uneven; they must then be filed to correct shape and the gullets to uniform depth. Clamp the saw in a

saw-filing vise and file straight across, disregarding the bevels. File down into the gullets until one tooth is brought to a point, and until half of the flat top of the next tooth has been removed. File the next gullet the same way, and continue to the end of the saw.



RIPSAW



UNEVEN RIPSAW TEETH



CROSSCUT SAW



JOINTED RIPSAW TEETH



JOINTING WITH SAW JOINTER

POPULAR SCIENCE MONTHLY SHOP DATA FILE



ODD STAGE EFFECTS, like these dancing marionettes, can be produced by coating with substances that glow under ultra-violet light. Below, the heated mixture of indelible-pencil lead and boric acid absorbs light and shines after the flash is turned off



CHEMICALS that glow with magic colors in the dark, under invisible illumination with "black light," have been applied to theatrical costumes and decorations with spectacular effect. Your own home laboratory can be the stage for equally striking experiments with these substances, which possess the curious property known as fluorescence. Also, you can prepare other substances that shine in the dark through the phenomenon called phosphorescence—which is distinguished from fluorescence by the fact that phosphorescent chemicals continue to glow for some time after removal from the light that excites them.

To make a phosphorescent preparation, simply break off the point of an indelible lead pencil and pulverize it thoroughly with a pinch of powdered boric acid (boracic acid), which you may find awaiting use as an eye lotion in the family medicine chest. Heat the mixture in a tin-can lid with the aid of a Bunsen burner, an alcohol lamp, or the kitchen range. The pulverized mass will twist and squirm, finally becoming shiny and glasslike. When the lid and its contents have cooled, hold the product close to an electric light. Then turn off the light, and if the room is dark you will see the

preparation glow vividly. Its light will gradually dim and disappear.

You can obtain phosphorescent light of different colors by heating boric acid powder with household dyes, or with a bit of fluorescein, and varying the heating so that the boric acid is only partly fused.

For black-light experiments with fluorescent chemicals, you will need a source of ultra-violet rays. The handiest is an argon lamp bulb, which you can obtain from any large electrical store for about half a dollar. Screwed into any lamp socket providing the ordinary house current of 110 volts, it emits a quantity of invisible ultra-violet light, besides some visible violet light. The lamp bulb may be fitted with a cup-shaped shade, to concentrate its rays upon your chemical bench, and to screen the visible light from your eyes so that it will not interfere with your observations.

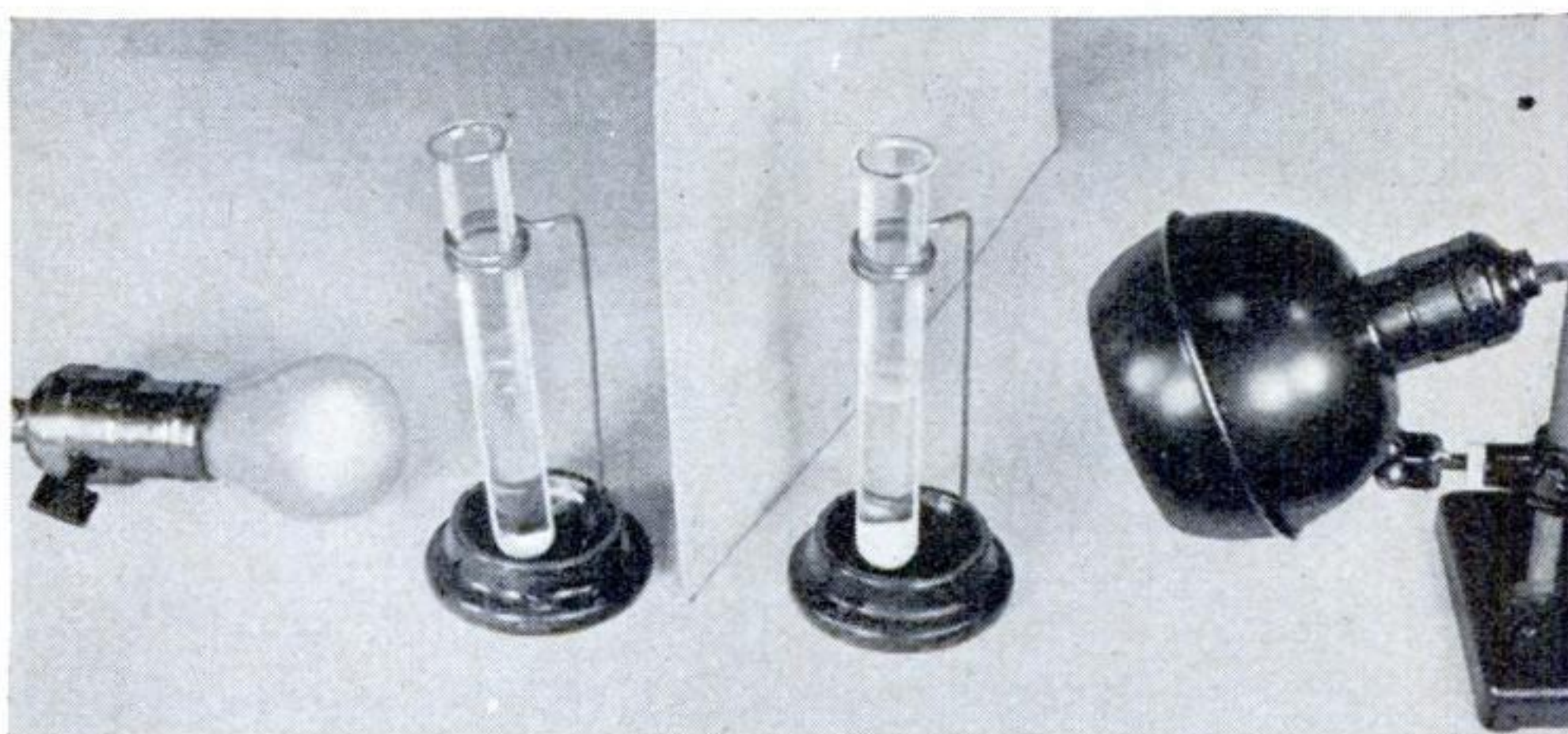
Many other sources of ultra-violet light are available for your experiments. Even direct sunlight will enable you to observe the fluorescence of a few chemicals, though in most

By
**RAYMOND
B. WAILES**

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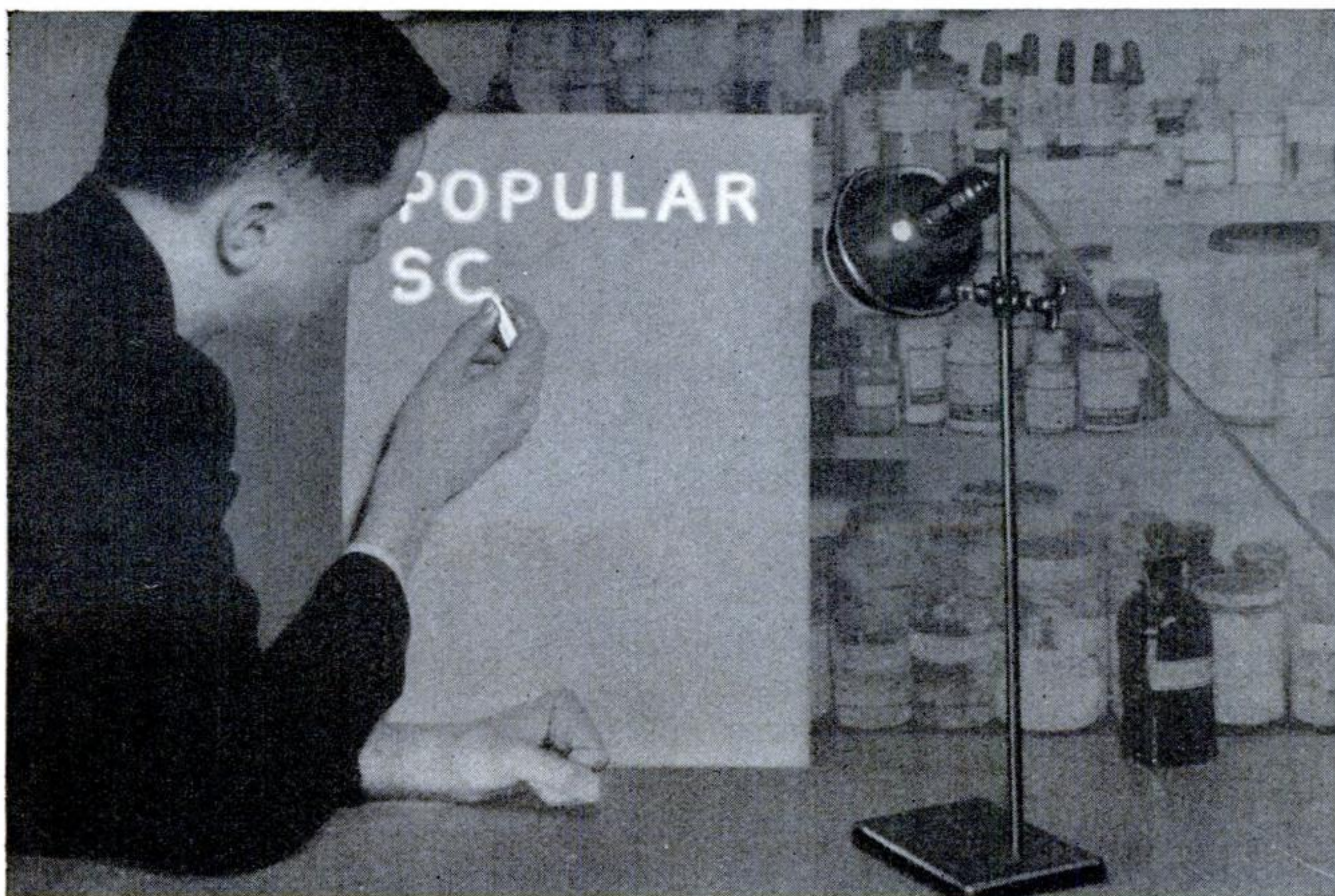
cases the brightness of the visible part of the sunshine masks their fluorescent glow. A photo-flood lamp will provide you with black light if you inclose it in a well-ventilated box, lined with asbestos paper, and let light emerge only through a window of special ultra-violet filter glass. This purple-black glass, opaque to practically all but ultra-violet rays, may be obtained from dealers in scientific apparatus and chemicals. If your home laboratory does not have 110-volt current on tap, you can produce ultra-violet light of sufficient intensity for many experiments with an iron spark gap, connected to a battery-operated spark coil.

To start your black-light experiments, you need look no farther than your own household for fluorescent materials. Ordinary ma-



Ultra-violet rays affect camera film more strongly than ordinary visible light does, as proved by this simple test with a light-sensitive solution

chine oil, exposed in a darkened room to your source of ultra-violet rays, will glow with blue light. So will petroleum jelly from the medicine cabinet. Calomel, or mercurous chloride, in solid form, will fluoresce under like conditions with a peculiar orange-gold color. Pyrogalllic acid, familiar as a photographic developer, also exhibits fluorescence upon exposure to black light. However, more



Here's a spectacular stunt of chemical magic—writing in letters of flame on a "blackboard" of white cardboard. The chalk has been dipped in a chemical that fluoresces under ultra-violet light

spectacular tricks of chemical magic can be performed with anthracene, a coal-tar product that will glow vividly with a yellowish-green color in ultra-violet light. Dissolved in benzine (benzol), gasoline, or xylene, it makes an invisible ink with which you can write secret messages on paper. When the writing dries, it cannot be seen in ordinary light. Hold it before ultra-violet rays in a dark room, however, and it will glow in letters like fire.

HERE is an entertaining variation of the stunt, to perform before your friends. Darken a room in which you have set up a white sheet of cardboard as a "blackboard." Dip a stick of chalk momentarily in a xylene or benzene solution of anthracene, and let the chalk dry. Then write with the prepared chalk upon the white "blackboard," which must be illuminated meanwhile by black light. The message will be traced in fiery, glowing letters, with mystifying effect that you can enhance by clever showmanship.

Small dolls, whose clothing has been dipped in anthracene solution and dried, will also fit well into any program of chemical magic. They glow weirdly when you make them dance under black light. For a two-color effect, impregnate only part of the clothing with the anthracene solution, and the rest with a solution of sodium salicylate in water. When dry, the latter fluoresces under black light with a pale-blue color.

Even in daylight, a solution of fluorescein in water will visibly fluoresce. A mere speck of the chemical, no larger than a pinhead, will suffice to make a quart of solution. To help dissolve the fluorescein, add a gram or

quarter teaspoonful of sodium hydroxide (lye) to the water. The fluorescence of the solution becomes far more vivid under black light. Use the liquid to fill a round-bottomed flask, or a burned-out electric light bulb with the base removed, and you will have a "crystal-gazing globe" that will magically glow in the dark when illuminated by ultra-violet rays.

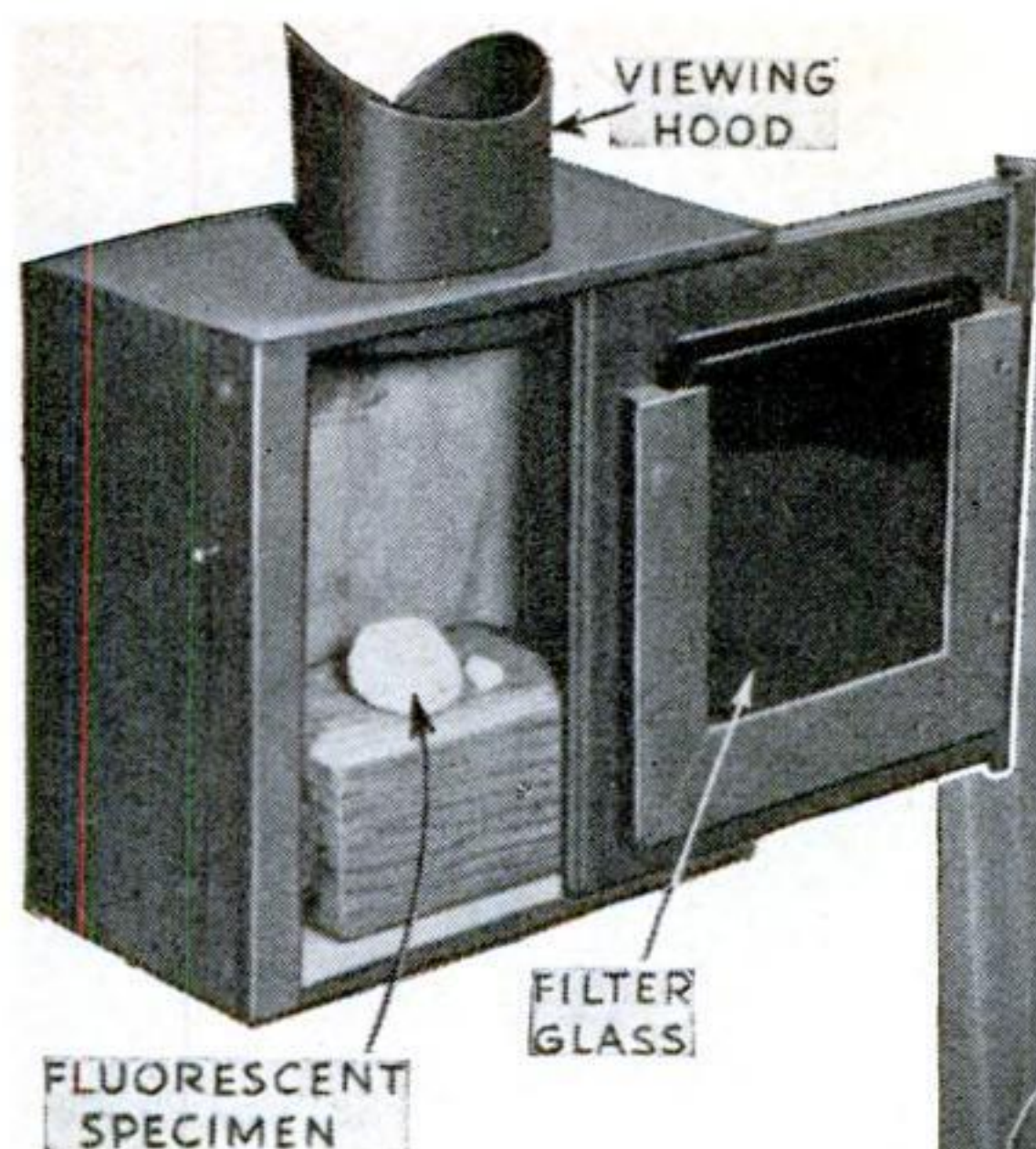
To make another preparation whose fluorescence can be seen in sunlight, add a solution of ammonium fluoride to a solution of uranium nitrate until no more precipitate forms. Filter off the precipitate, which is a uranium compound called uranyl ammonium fluoride. Wash it with alcohol while it is still on the filter paper, let it dry, and then promptly stopper it in a bottle. This solid substance, like the fluorescein solution, fluoresces much more brilliantly in the dark, under an argon lamp.

Increasing the power of your black-light source enhances the luminous response of fluorescent substances, and you can do this by mounting several argon lamps close together on a board. Wire them in parallel, or so that each receives its supply of current independently of the rest. As the argon bulbs consume only two watts apiece, a dozen or two of them would use no more current than a standard twenty-five or fifty-watt bulb.

To observe fluorescent effects at their best, another expedient is to place the substance under observation in a homemade viewing box, which is used in conjunction with your source of black light. A sliding cover on the



SUN-TAN OINTMENT. You can demonstrate how popular lotions prevent sunburn by shielding the skin from ultra-violet rays. Your test lotion is mixed from lanolin, paraffin oil, and a few phenol salicylate tablets



HOMEMADE VIEWING BOX. Fluorescent effects are seen to best advantage in a viewing box, which you can make for yourself. Black light is admitted through a window of filter glass, and you view specimens through a hole



box will facilitate inserting and removing your specimens. Fit one end of the viewing chamber with a window of ultra-violet filter glass, of the special type previously mentioned, which is available in several sizes. While the window admits black light to the specimens in the box, you can view them through a hole cut in the top. Any leakage of visible light into the box may be prevented by surrounding the peep hole with a masklike shield that fits your nose and forehead.

Such a viewing box will enable you to observe the fluorescence of many more substances. Common buttons glow with a blue color, which cannot be seen by the unscreened argon lamp because its own visible light masks the faint blue fluorescence. Uranium-tinted glassware, yellow-green in color and found in many households, will also fluoresce in the viewing box.

DYES in particular are apt to exhibit fluorescent properties under the rays. An alcoholic solution of rhodamine will glow red. A solution of uranin in water will shine with yellow light. Many minerals, too, show fluorescence. Some substances—including the preparation of boric acid and a dye, described in an earlier paragraph—are both fluorescent and phosphorescent.

Camera fans know that light rich in ultra-violet rays will act much more strongly than visible light alone upon a photographic film. You can easily make a light-sensitive solution that will respond to different kinds of light in similar fashion. Dissolve about five grams, or a teaspoonful, of ammonium oxalate in 100 cubic centimeters (about three and a half fluid ounces) of water. Make another solution of five grams, or a half tea-

spoonful, of mercuric chloride in the same amount of water. Mix the two solutions and filter. Place equal amounts of the filtered mixture of liquids in each of three test tubes.

Expose one tube overnight to light from an argon bulb, and another tube, for the same length of time, to the light of an ordinary electric-lamp bulb. A screen may be placed between the bulbs so that each tube is illuminated by only one type of light. Meanwhile keep the third tube in a dark place to serve as a "blank" or reference standard.

After twelve or more hours, you will find a considerable deposit of white crystals in the tube exposed to the argon lamp. The test tube lighted by an ordinary bulb will contain only a third or fourth of this amount, and none at all will be found in the tube kept in the dark. Ultra-violet rays, most abundant in the first case, promoted a reaction between the ammonium oxalate and mercuric chloride to produce the white precipitate, which consists of mercurous chloride.

Sunburn is another sort of chemical action produced by black light. "Sun-tan ointments," popular at this time of year, prevent sunburn by shielding the skin from an overdose of the ultra-violet rays in sunlight. To show how they filter out the rays, heat about five cubic centimeters (a teaspoonful and a half) of liquid paraffin oil or petroleum jelly. Dissolve two or three salol (phenol salicylate) tablets in the hot oil or jelly. Mix the product with about ten grams of lanolin to form an ointment. *(Continued on page 232)*

Ice placed in boiling water chills it more than ice water at same temperature

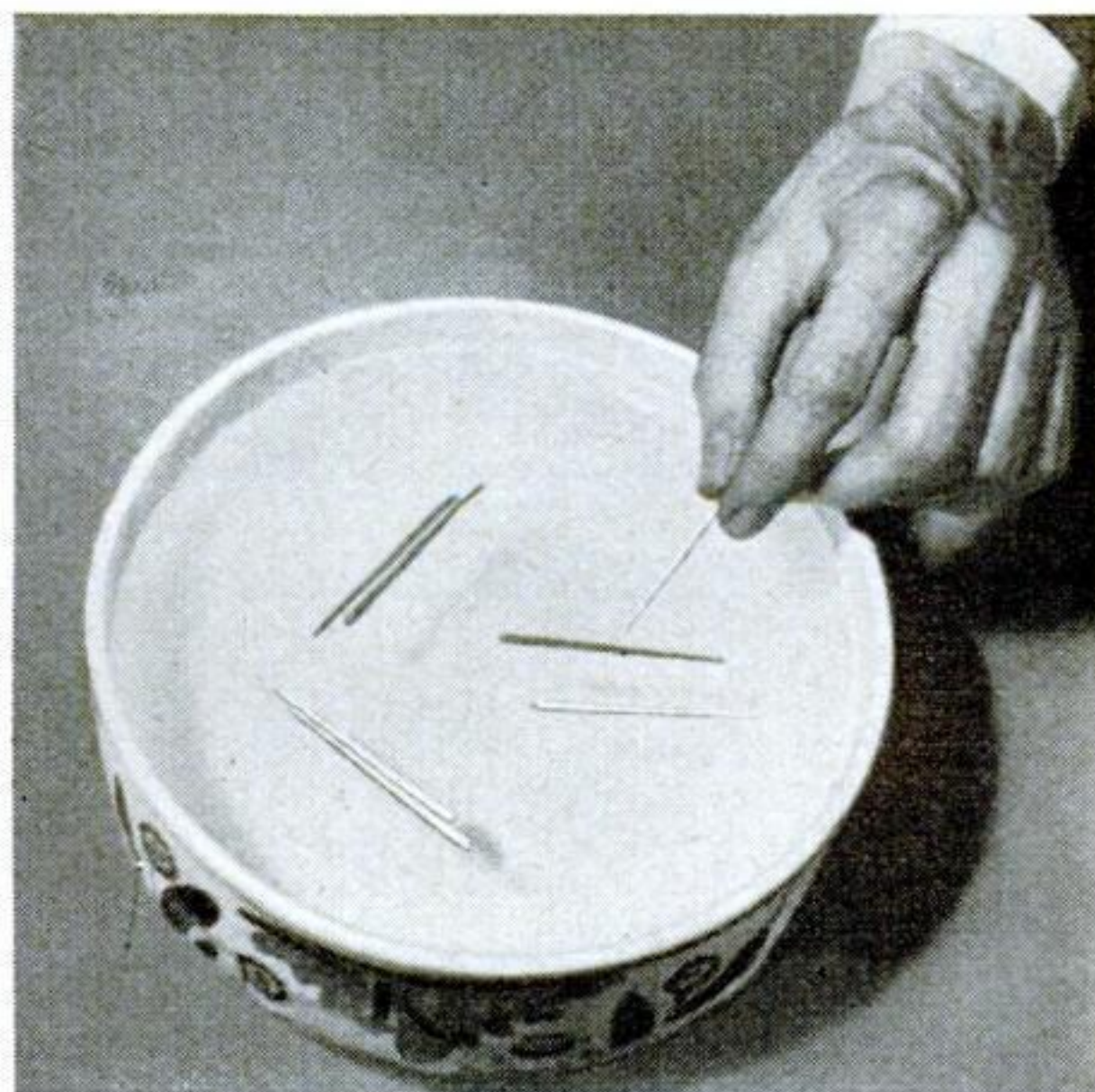
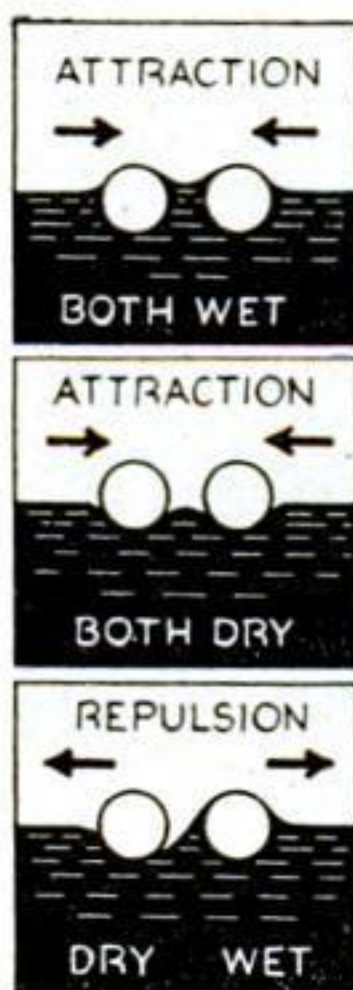


SCIENCE

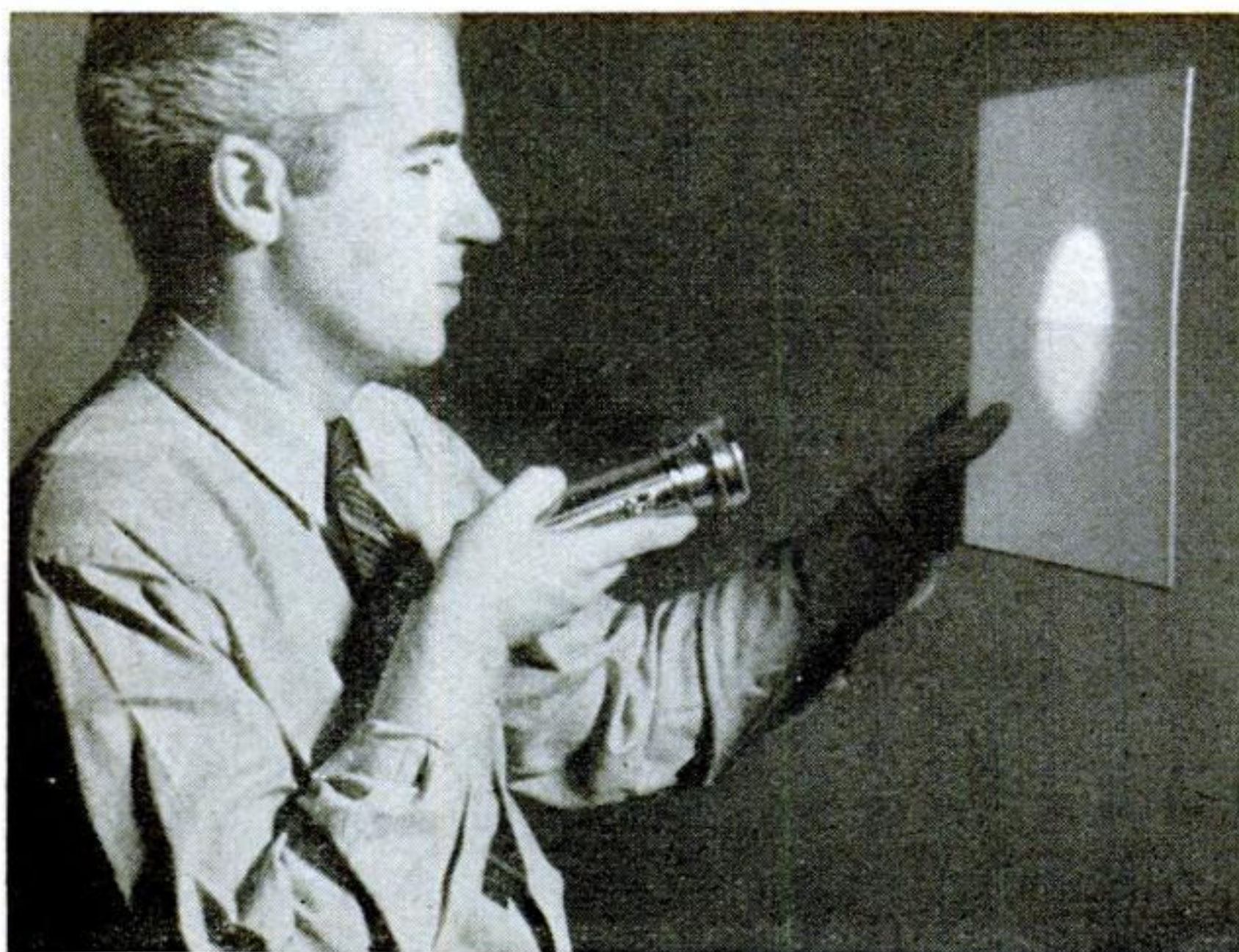
POUR equal amounts of boiling water into two containers. To one portion, add an equal quantity of ice water chilled to thirty-two degrees F. Add a like amount of melting ice, at the same temperature, to the other portion. Stir each. The water in the first container drops from 212 to about 122 degrees, a thermometer will show. But the second portion, when the ice has melted completely, drops to about fifty degrees! The extra heat stolen from the water is the amount required to change ice from a solid to a liquid, without altering its temperature, and is called the latent heat of fusion.

Freaks of Surface Tension

WET two toothpicks thoroughly. Placed near each other in a pan of water, they will drift together. So will a pair of dry toothpicks, lowered so carefully to the surface of the water that their tops and sides do not get wet. Now repeat the experiment with one wet toothpick and one dry one. Gently move the first toward the second as shown in the photograph, keeping them parallel, and the dry toothpick will be pushed away before contact occurs. The small sketches show how the varying effects of surface tension play these strange tricks, causing attraction or repulsion, as the case may be.



Floating toothpicks attract or repel each other strangely



With increasing distance, green shows more brightly than red

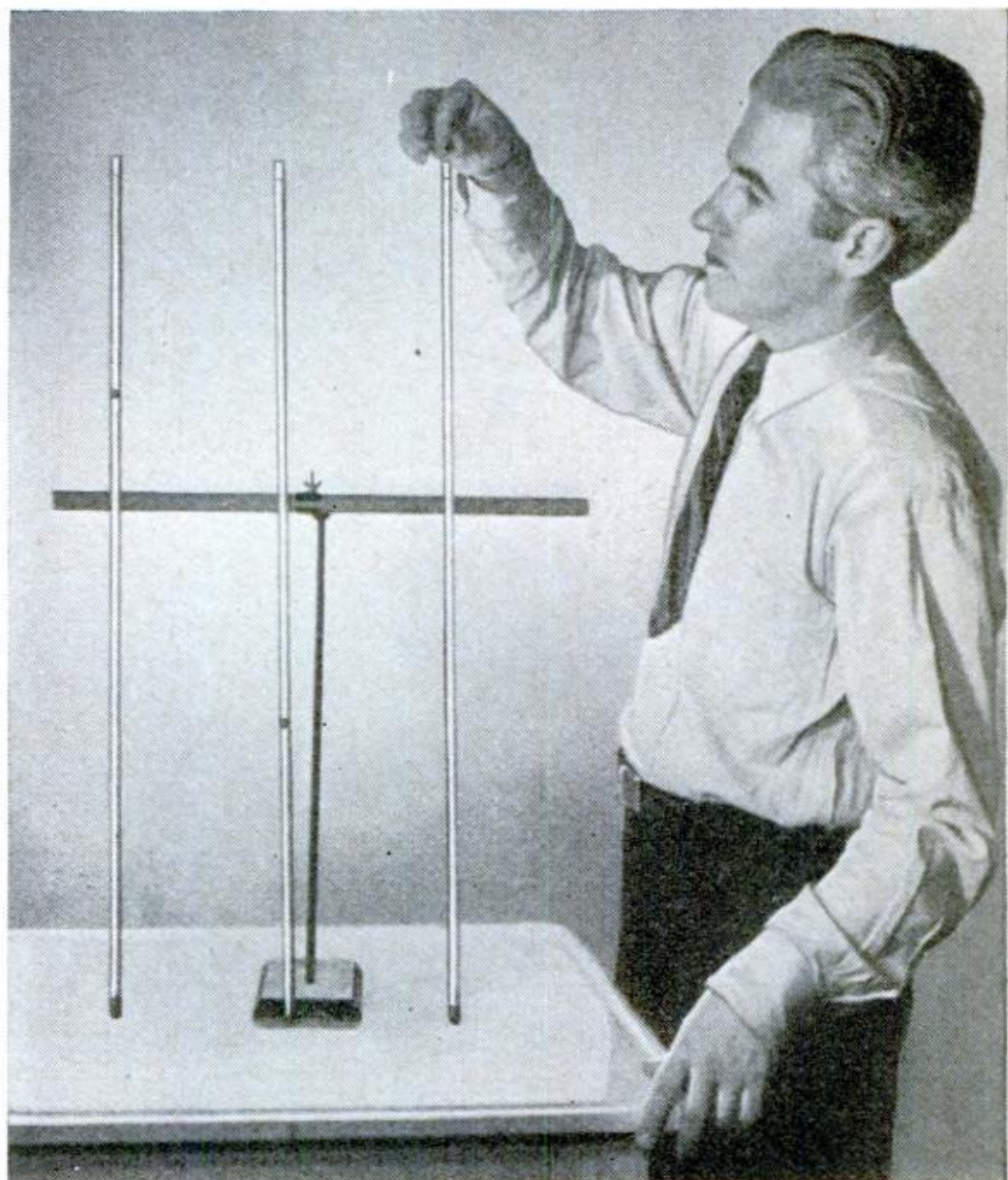
Color Vision Changes as the Light Fades

COVER half of a flash-light lens with red paper and the other half with green, using several thicknesses. In a dark room, shine the lamp on white cardboard at close range. The red patch of light looks brighter. Slowly move the flash light away from the cardboard screen. The green light gains in relative brightness, finally surpassing the red. Dim light alters the eyes' sensitivity to colors, which explains why red flowers turn black as twilight falls, while blue ones keep their color longer. The greens are last to fade as failing light makes all look gray.

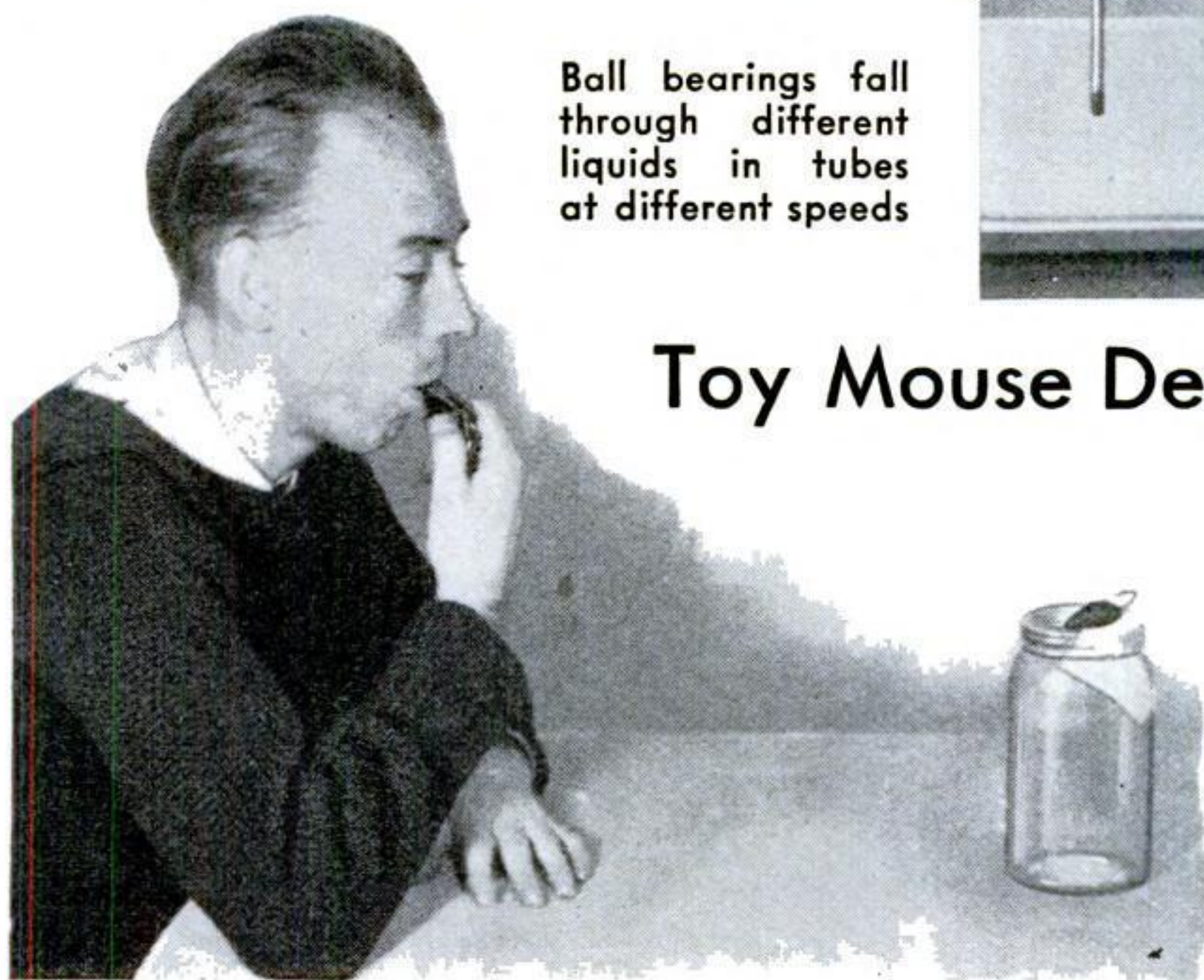
IN EASY TESTS

Test Shows Differences in Liquid Viscosity

SUPPORT three or four long glass tubes in an upright position, and plug the bottom of each. Fill one tube with water and the others with different liquids. See how long it takes ball bearings, dropped in the top, to reach the bottom of each tube. This depends upon the viscosity, or internal friction, of the particular liquid. If a ball takes one second to traverse the tube of water, it would require only a third of a second to fall through a similar column of ether. In olive oil, it would take eighty seconds; in glycerin, twelve and a half minutes; while if it were dropped in pitch, it would take 10,000 years!



Ball bearings fall through different liquids in tubes at different speeds



Blow the whistle, and the mouse jumps obediently into the jar

Toy Mouse Demonstrates Resonance

TIE a stretched piece of paper over half the mouth of a glass jar. Place a toy mouse or other small object near the edge. Blow a blast on a whistle. If the whistle's pitch matches the natural pitch or vibration period of the air column in the jar, which may be "tuned" to resonance by adding water, it will make the paper vibrate, and the mouse will dance about and jump into the jar. Notes of any other pitch will have little or no effect.

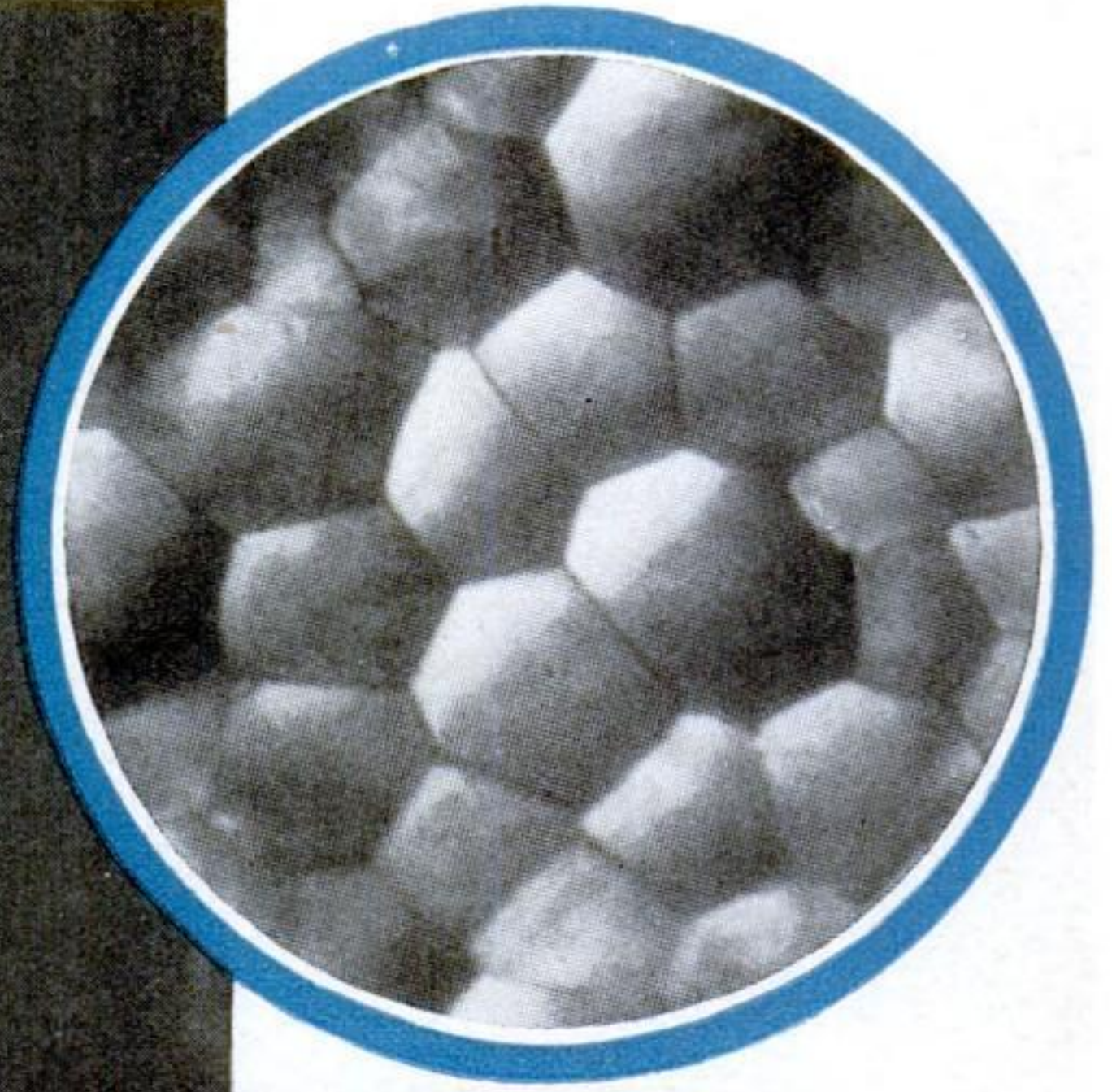
Sometimes You See Things by Not Looking at Them

AFTER several minutes in a dark room, look through a pinhole in cardboard at a flash light covered with green paper. The faint green light disappears if you gaze straight at it, but can be seen if you turn your eyes slightly aside. Astronomers must do the same to see faint stars. In the daytime, you see things most clearly by looking directly at them, so that the image falls on the center of the retina. When your eyes adapt themselves to darkness, however, the surrounding part of the retina becomes more sensitive than the center.



The spot disappears if you look right at it

Looking at Shells



Treating shells with dilute acid to remove the limestone that gives them strength. Note similarity between photomicrograph of a shell (circle), and the paving blocks in sidewalk at right

A CERTAIN street in Washington, D. C., has a sidewalk constructed of hexagonal stone blocks closely fitted together. Breakfast sausage comes incased in thin protective membranes.

You probably won't see any connection between the Washington sidewalk and the breakfast sausage until you turn your microscope on a piece of shell from an oyster, mussel, or other bivalve. And then, as you have noticed before in the course of your microscope adventures, you will see that man is just a big copy-cat; that nature, millions of years ago, was building structures like the prismatic sidewalk, and was protecting her building blocks with thin membranes like present-day sausage casings.

A bivalve shell is one of the most fasci-

nating objects you can examine with your microscope. You can spend an evening or two with it, and not lose interest. Even though you don't live near the ocean, you can find oyster shells and souvenir shells in the stores of any village or town. You can get a mussel shell in almost any stream whose water contains carbonate of lime. Select specimens having shiny, pearly interiors.

Maybe at first sight the shell you have doesn't look very interesting, except, perhaps, that the inside surface has a beautiful iridescence characteristic of mother-of-pearl. But with your microscope you will find that there is plenty of interest there.

When nature devised the mollusk shell, she had a number of problems to solve. She had to use easily obtained material, employ a

with Your Microscope

system of construction that would permit gradual growth, develop an arrangement of units that would give the required strength, and, finally, provide a means of protecting her work from surrounding detrimental conditions.

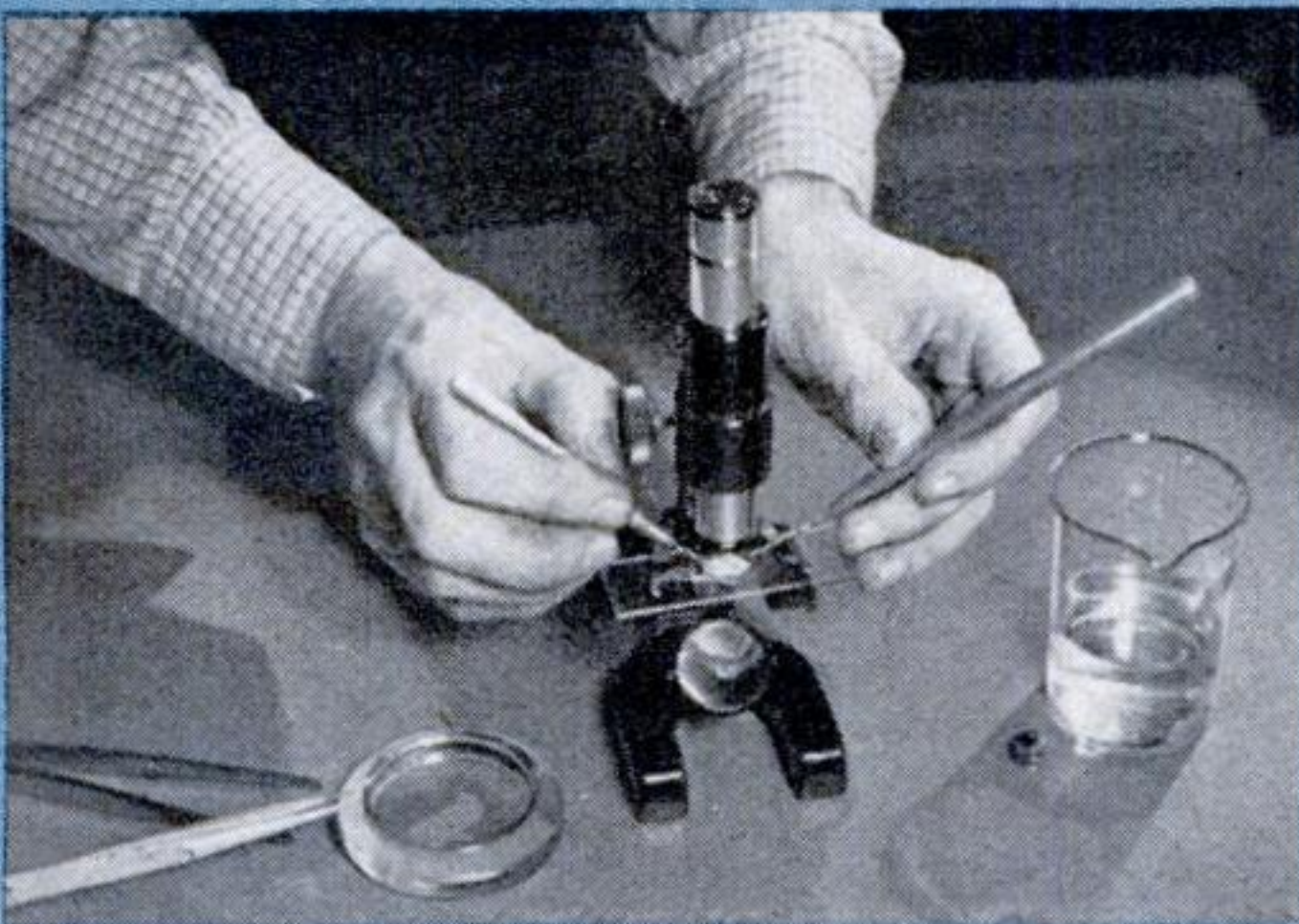
With a moderate power, say fifty diameters, examine the outer surface of a shell. You probably will be surprised to find that it has a definite and very beautiful structure. The surface, usually colored some shade of brown, is revealed by the magic lenses of your microscope to be made up of innumerable little blocks nestling together so closely that there is not an opening anywhere between them. Study the blocks carefully, and you will observe that many of them are six-sided. Here, then, is an arrange-

ment very much like that of the blocks in that Washington sidewalk.

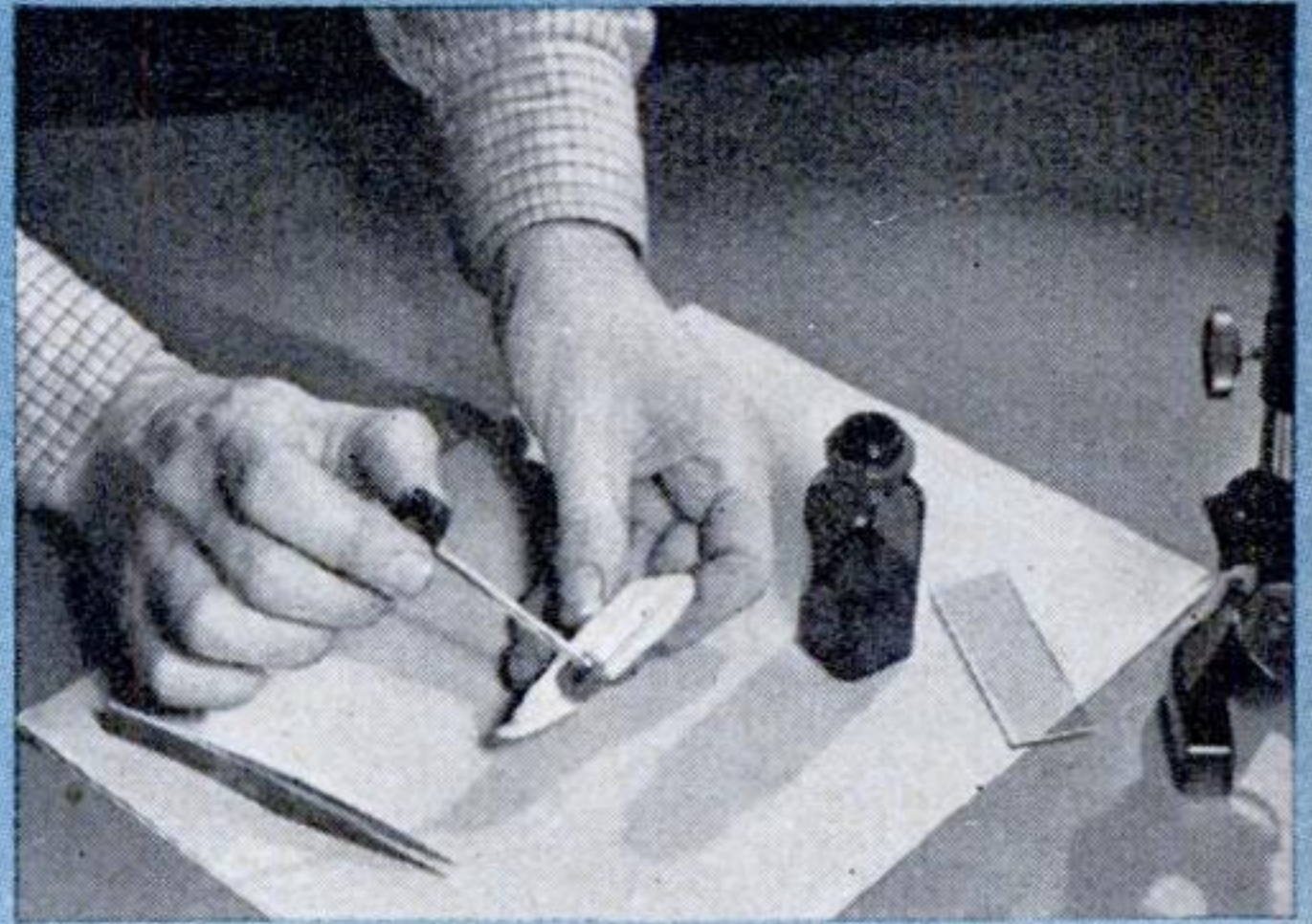
Slide the shell sideways until you can focus on a point at the very edge where the shell has thinned out until you can almost see through it. Here, again, you will observe the hexagonal-prism arrangement. Turn the shell over and focus again near the edge. You will see that the other side shows the prismatic arrangement, too.

You have been looking at the ends of tiny prisms consisting mostly of limestone. The building material (calcium carbonate) from which the prisms were fashioned was obtained from the water in which the creature bearing the shell lived. Had that water contained no lime, there would have been no shell—probably no animal. By now,

By
**MORTON C.
WALLING**



A shell treated with acid and placed under a microscope reveals its skeleton of thin animal membrane



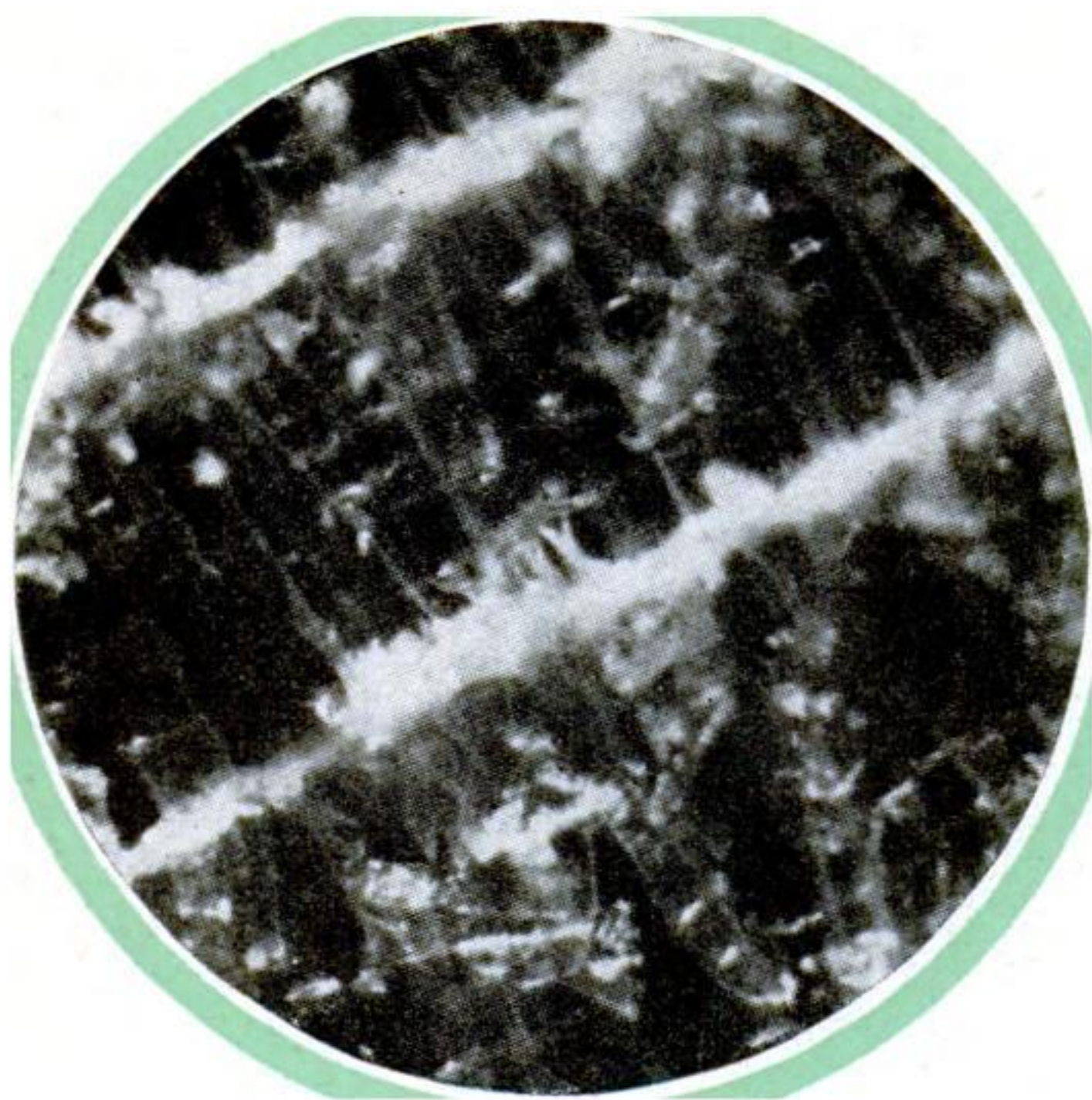
To obtain a cast of a shell's surface detail, apply a coating of collodion, let it dry, and peel it off



In making a shell section, grind it flat and polish it on a razor hone lubricated with water. Then . . .



using hot balsam, cement the polished surface to a microscope slide and grind and polish the other side



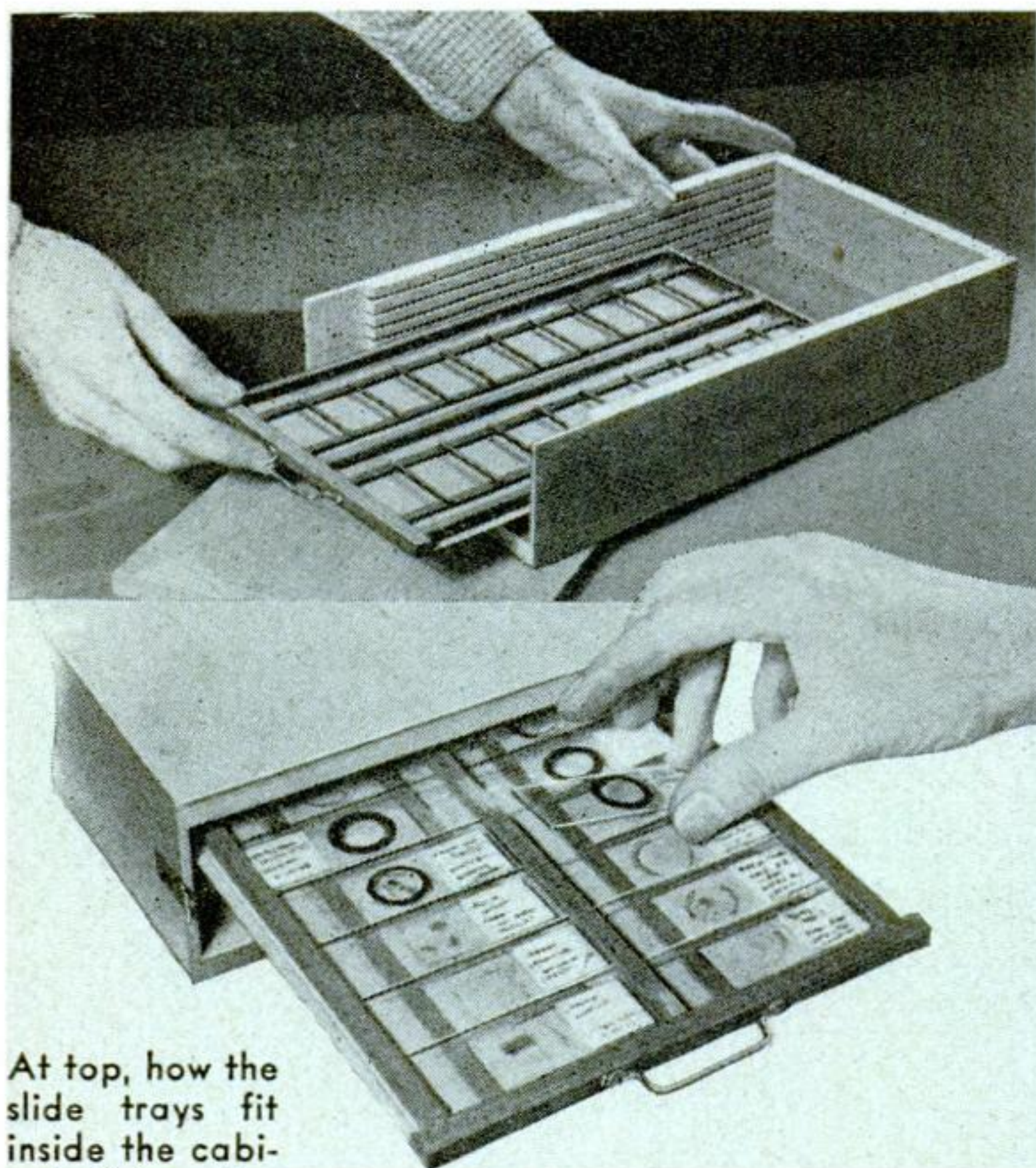
Magnified portion of a section of mother-of-pearl

you probably have begun to wonder what holds the blocks of lime together. And if you know anything about streams and lakes, you wonder how the shell has managed to remain reasonably intact when there is often carbonic acid in the water. An acid, you know, dissolves limestone.

Why not see what an acid will do to the shell? Make up a dilute solution of any acid such as sulphuric, nitric, hydrochloric or acetic (even vinegar will do), and place the shell in it. If the acid is strong, vigorous bubbling will be noted. It is best to use an acid solution not strong enough to cause violent bubbling. Leave the shell in it for several hours.

After the bubbles have ceased to form, you will not see much change in the appearance of the piece of shell. Pick it up carefully with tweezers, however, and you will find that it is now soft and pliable. Carefully transfer the specimen to a slide and examine it with your microscope. You will see the same prismatic structure, but since you know the limestone has been dissolved, the prisms must be made of something else. With teasing needles you can tear the prisms apart easily, and in this way you find that they are a skeletonlike framework of thin, animal membrane.

Nature, with characteristic cunning, had wrapped her carefully made carbonate crystals individually in a tough membrane to protect them from harm, particularly from the action of carbonic acid. If you remove the outer layer of the membrane carefully from the acid-treated specimen, you will find a network of hollow cells formed by strips of



At top, how the slide trays fit inside the cabinet. Below, the completed unit

• YOUR MICROSCOPE

DO YOU have trouble storing microscope slides? The usual method is to use a box or drawer having notched strips to hold the slides on edge. Although generally satisfactory, this has some drawbacks. Chief among them is the fact that some slides are damaged by remaining on edge for weeks and months.

Here is a storage arrangement that is an improvement over those usually employed. It provides for all the slides to be supported flat, where their labels can be read at a glance without moving anything. Furthermore, it is a simple matter to pick up a slide; you simply press on one end with a finger, the other end pops up, and you grasp it easily.

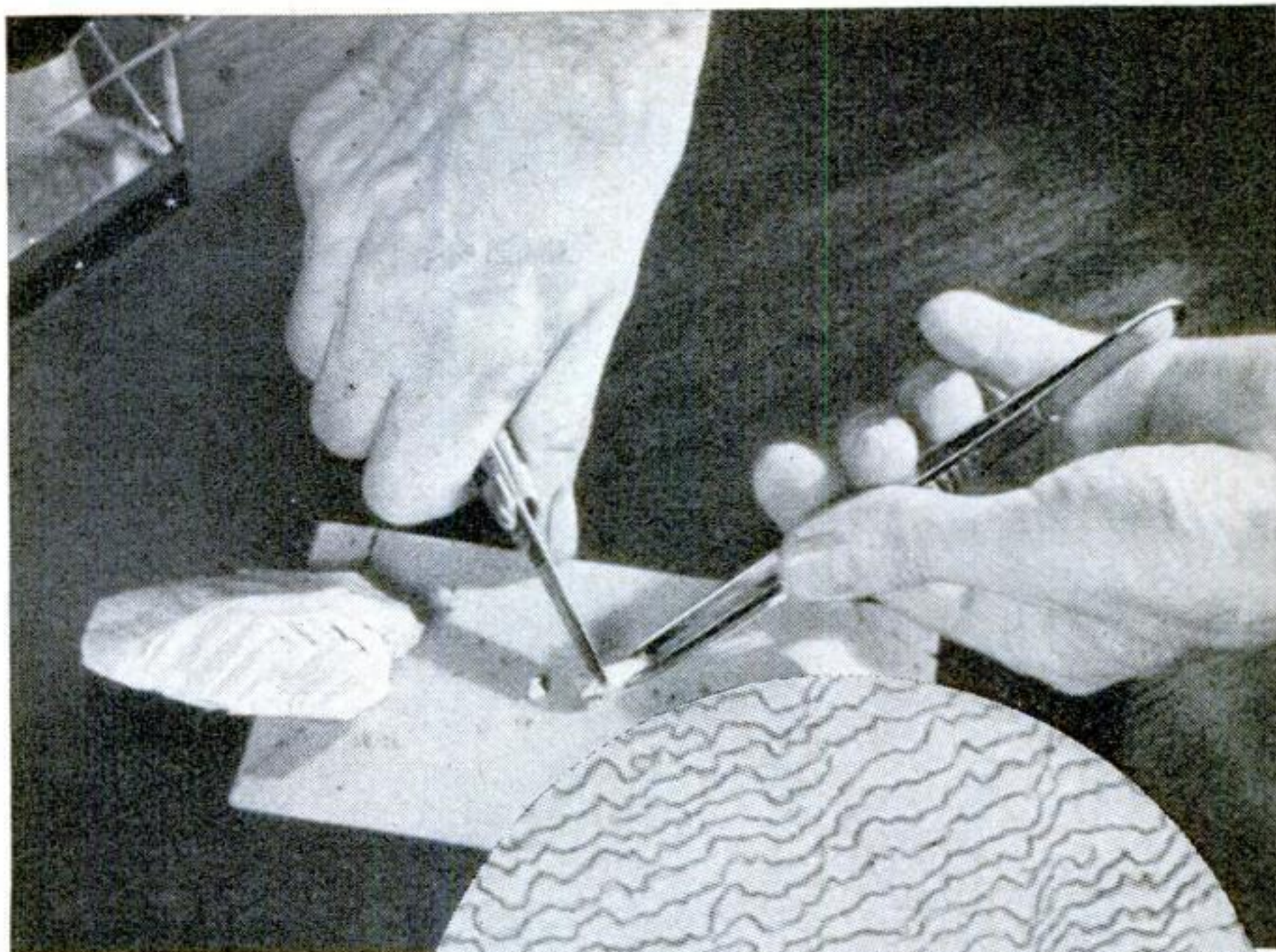
Make a series of shallow trays and a box or cabinet to keep them in. The tray bottoms consist of sheets of stiff sheet metal, such as galvanized furnace iron, which slide in saw grooves

the membrane that filled the thin spaces between crystals.

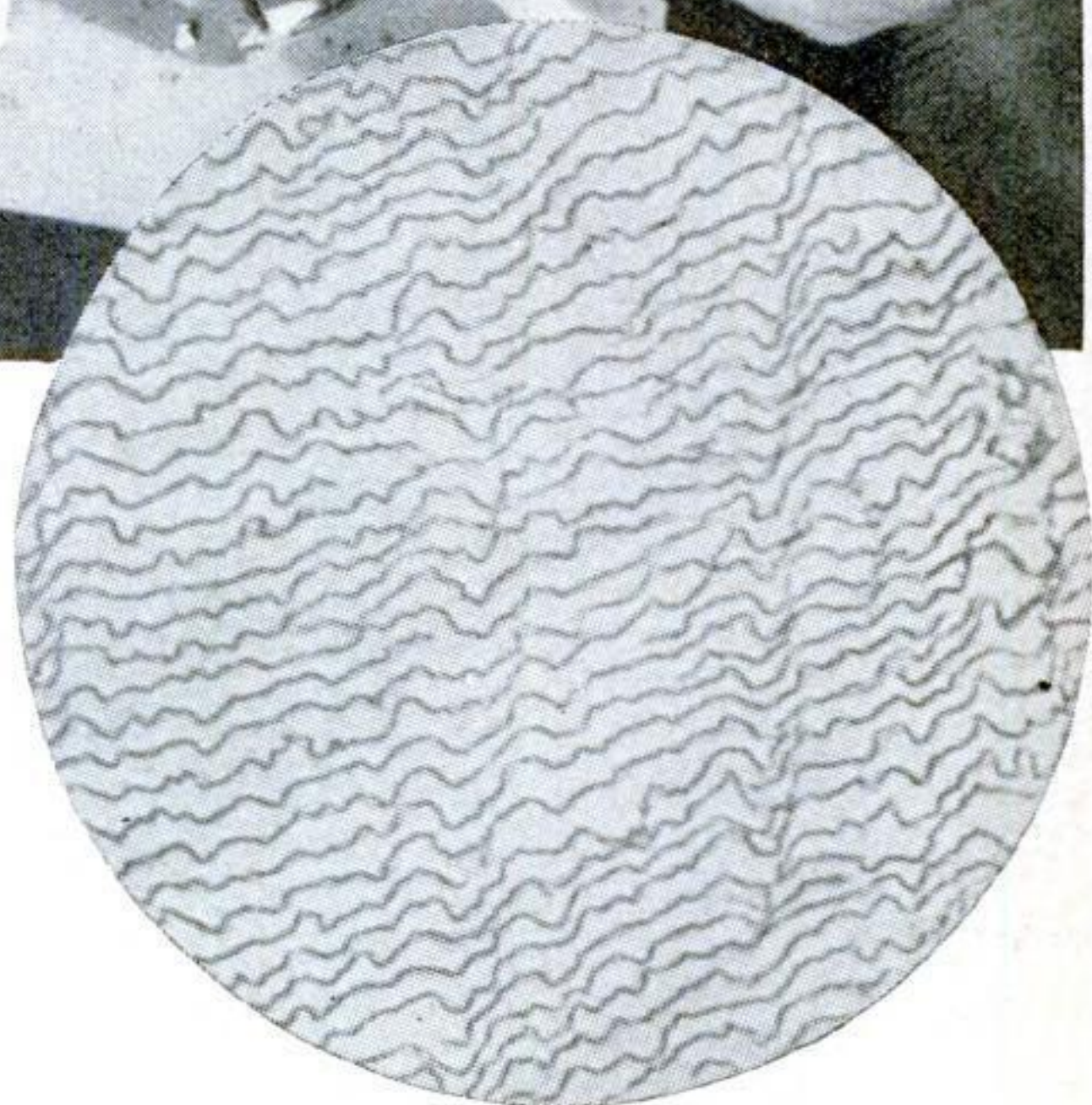
Going back to the point where you were looking at the inside surface of an untreated shell, near the edge, you found that the crystalline arrangement was visible there. Now move inward from the edge, and you note an abrupt and extensive change in the landscape. Instead of a mosaic of prisms, you find a maze of fine, wavy, nearly parallel lines that remind you perhaps of the grain of yellow pine, cypress, or other wood. This is the mother-of-pearl lining of the shell, or the nacre.

You may have difficulty in seeing the lines at first. Use at least fifty diameters, and arrange the illumination so that it strikes the surface obliquely from one side. By moving the lamp up and down, and forward and back, you will find the best position. Incidentally, the crystalline layer can be examined in this way too, but it usually looks better by transmitted light, if the shell is not too thick.

The mother-of-pearl is made up essentially of numerous, very thin folded (*Continued on page 234*)



Cuttlefish shell is soft enough to be cut with a knife. Right, magnified section of the shell



SLIDES WILL BE SAFE AND ACCESSIBLE IN THIS CABINET •

cut in the sidepieces of the cabinet. Each tray has a frame made of wood or metal, and these are divided into recesses or compartments for the slides. Each slide is supported by two thin strips of wood or cardboard running parallel to its shorter edges and about $\frac{1}{2}$ " from them. This arrangement enables the slides to be tilted by pressing down on one end. At right angles to the supporting strips are spacing strips, which can be match sticks, held in place with glue. It is not absolutely necessary to use these spacers, but they provide some protection for the slides and therefore are worth the extra effort.

Dimensions and arrangement of parts for a typical cabinet are shown in the accompanying drawings, which you will find easy to follow.

These drawings give full details for constructing the cabinet

New Developments in

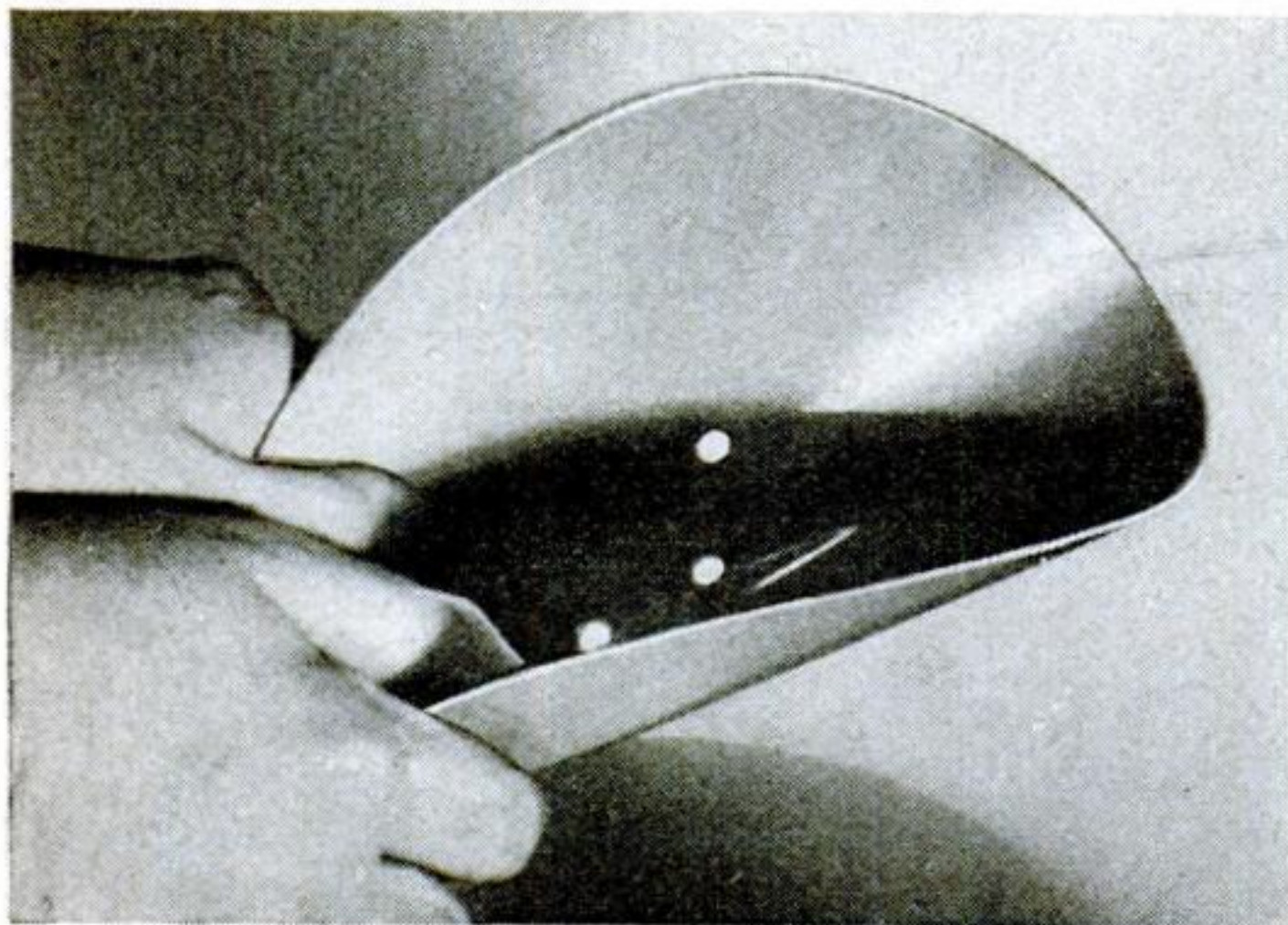


This television unit can be coupled to your regular broadcast receiver

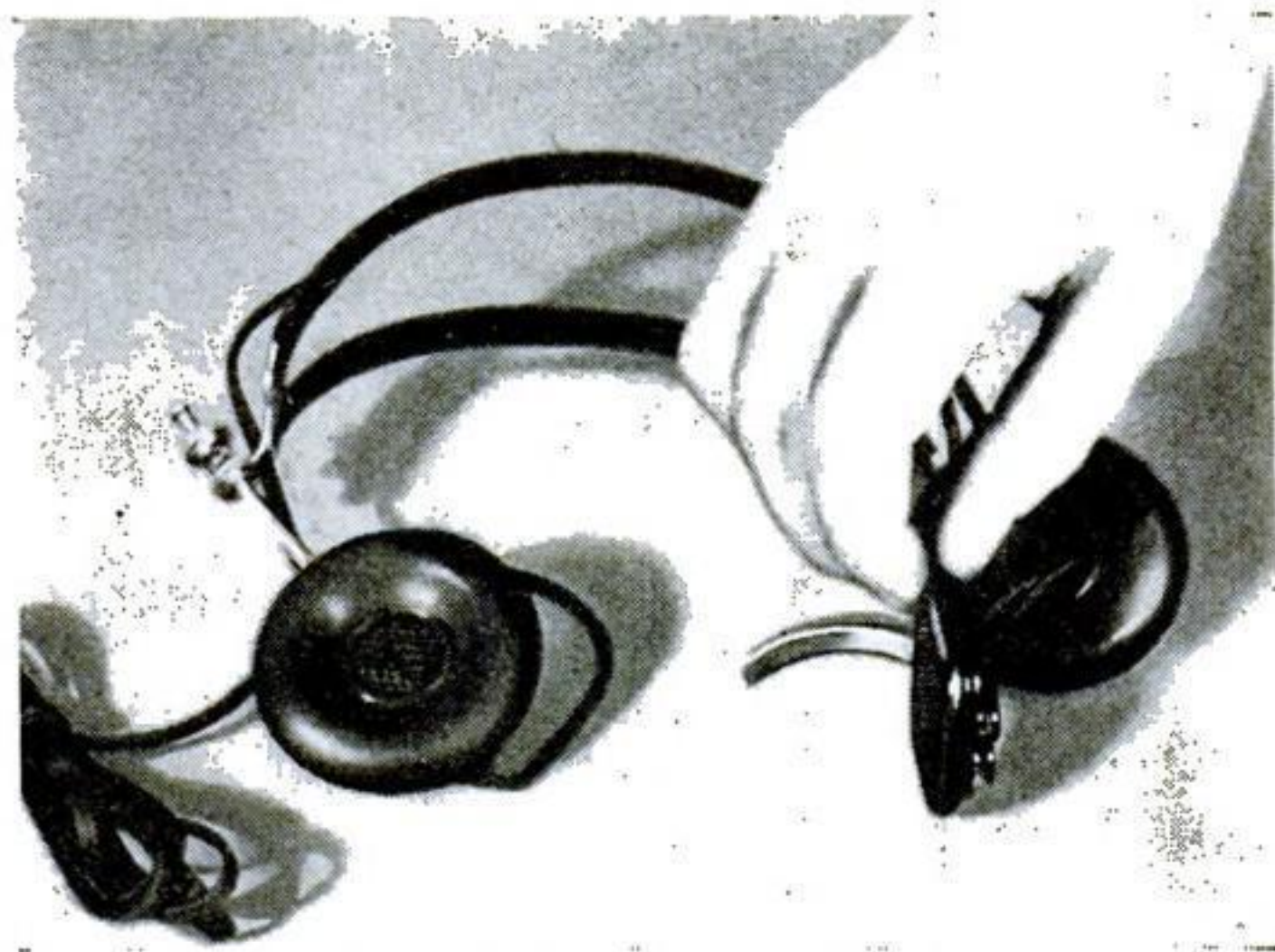
WITH the compact television converter unit illustrated in the photograph at the left, your regular broadcast receiver can be used to receive the sight-and-sound programs now being broadcast on regular schedules. Connected to a receiver, it not only provides the necessary vision circuit and cathode-ray viewing screen, but it serves as a converter to adapt the regular broadcast circuit in the receiver to the ultrashort waves on which the sound accompanying the "vision" programs is sent out on the air. The sound signals are separated by the converter and then fed into the broadcast receiver's amplifier and loudspeaker. A $3\frac{3}{8}$ by $4\frac{3}{8}$ inch image is produced on the unit's viewing screen. The cabinet can either be placed on a table or on top of the regular broadcast receiver.

Flexible Phonograph Disk for Home-Recording Use

SO FLEXIBLE that it can be bent almost double without breaking, a phonograph disk for making home recordings is now being marketed for radio experimenters and others interested in sound reproduction. The disk is made of fiber to which a thin film of plastic material is added under pressure at intense heat. It is said to be fireproof.



Don't try this with an ordinary phonograph record!



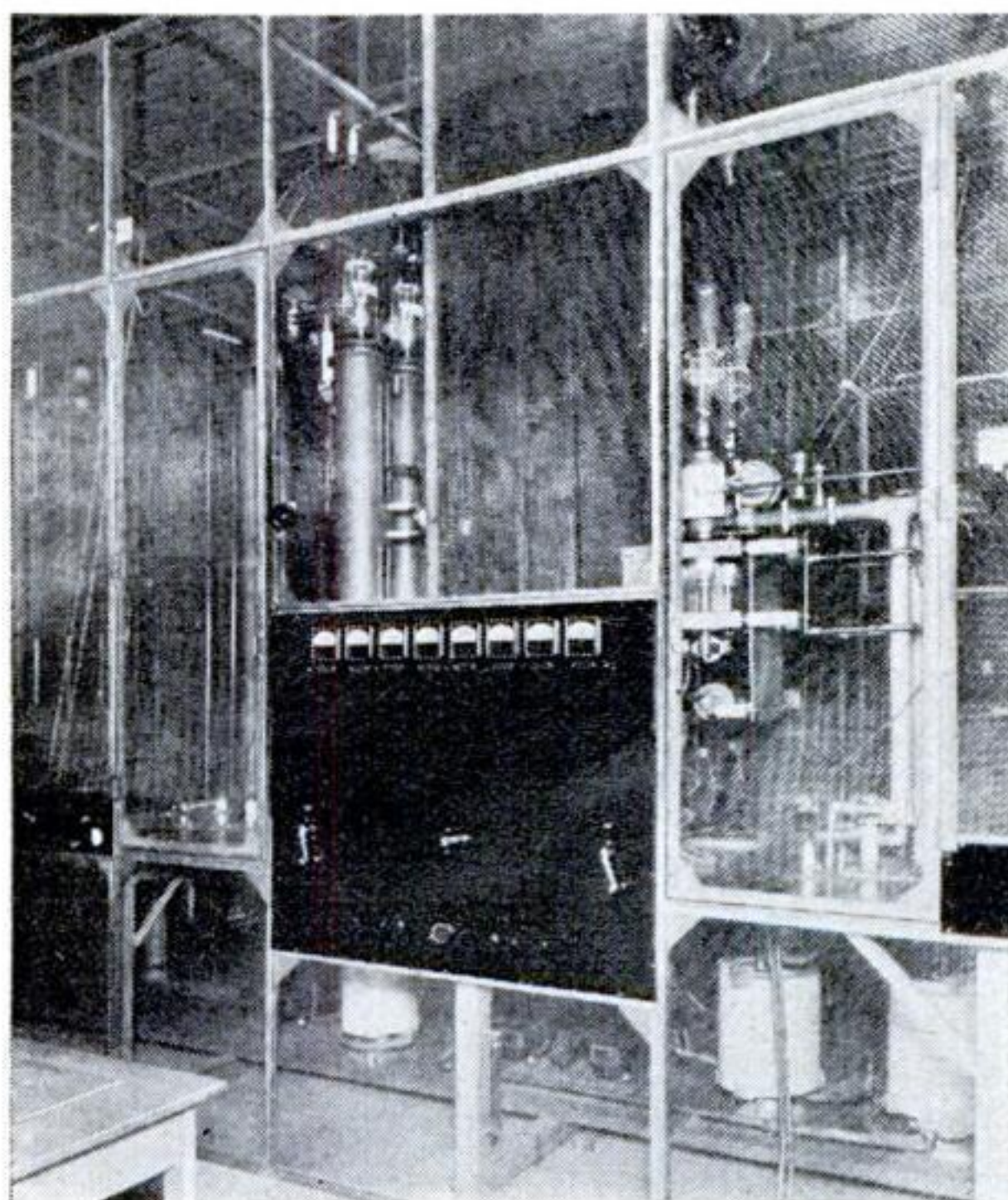
New Wafer-Thin Phones Are Light in Weight

ONLY three eighths of an inch thick—slightly thicker than a pencil—new headphones just introduced have the added feature of light weight to appeal to amateur and professional radio operators who wear headsets for long hours at a stretch. The crystal elements of the receivers are housed in hermetically sealed aluminum cases, and composition diaphragms eliminate chatter.

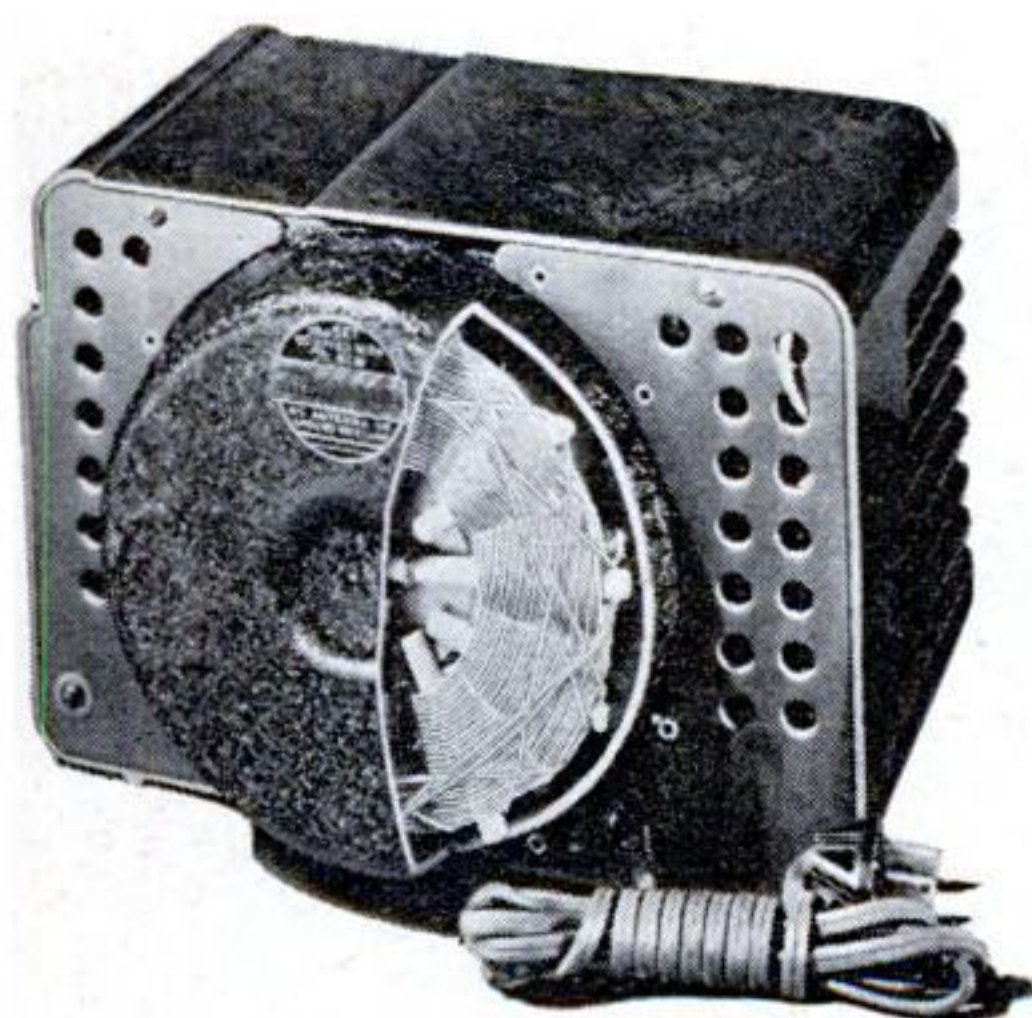
the Radio World

"Staticless" Radio Station Completed

THE WORLD'S first "staticless" radio station is now operating near New York City. From its giant 400-foot tower overlooking the Hudson River, daily test programs are being broadcast on the ultrashort waves over a radius of 100 miles. The "staticless" radio system, devised by Major Edward H. Armstrong, (P.S.M., July '35, p. 16), makes use of an entirely new method of imprinting the voices and music on the radio waves. In regular broadcasting, wave strength is varied by the sound volume. In the new system, the strength of the waves is kept constant while the width of the wave band is varied. Because this creates a wave pattern unlike static, natural interference as well as unwanted circuit noises are completely suppressed.



At left, amplifiers in the new staticless transmitter. Above, its 400-foot-high antenna tower

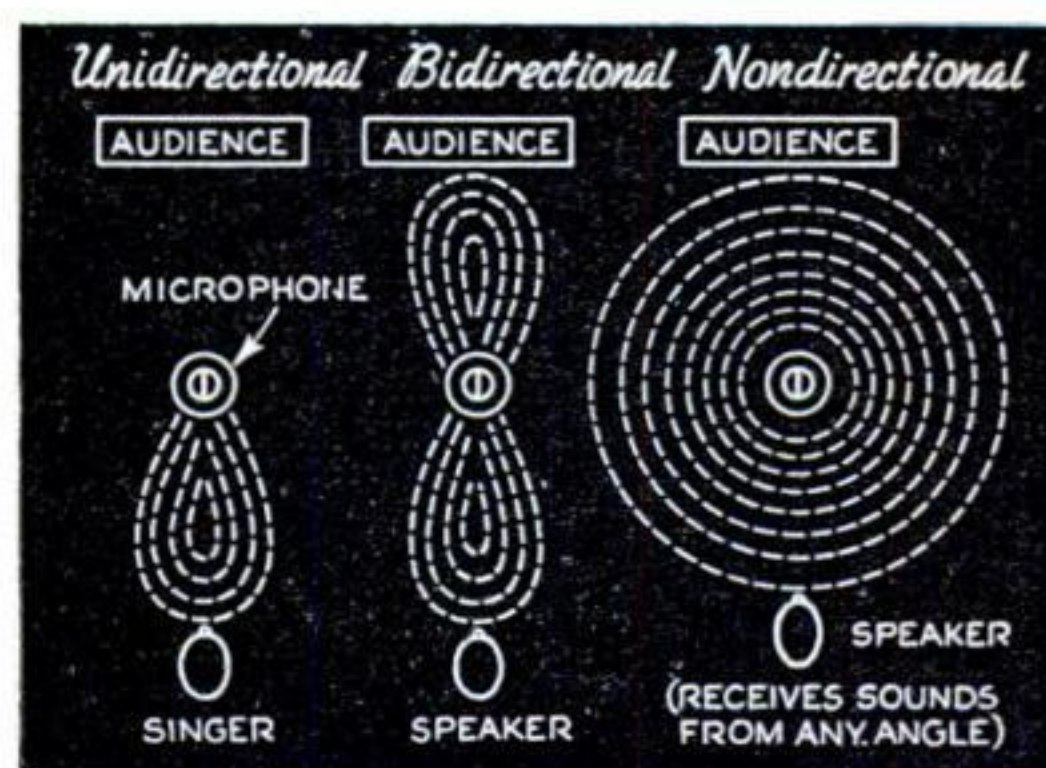


Tiny Loop Antenna Built into Radio

OF SPECIAL design and shielding, midget broadcast receivers with built-in, loop antennas are now available, thus dispensing with outdoor or around-the-room aerials. Increased selectivity and less static are claimed for the sets.

Mike Picks Up Only What Is Wanted

BY FLIPPING a switch attached to its base, a microphone just marketed can be made sensitive to sounds coming from in front, from two sides at once, or from all sides at once, as desired. Actually two microphones in one—a bidirectional unit and a nondirectional instrument—the output of each runs to the switch which cuts in one or the other, or both in series. In the latter position, the units are sensitive only to sounds coming from the front, as in the diagram. Designed for both radio and public-address systems, the mike is quickly adaptable to the needs of any size studio.



How the switch controls the microphone

Easily Assembled Unit

WITH the easily assembled unit illustrated, you can convert your regular superheterodyne set into a "diversity receiver" that will provide signals of constant strength free from the bothersome fading so common to short-wave reception and often experienced on the broadcast band. Called a "diversity coupler," the unit operates on the same principle as the "diversity receivers" (P.S.M., Mar. '39, p. 222), but what the receivers do electrically, the coupler does mechanically).

The secret of diversity reception is based on the fact that the degree of fading of a

given signal varies with different antennas. The coupler, acting as a link between two antennas—one vertical and the other horizontal—and the receiver, automatically couples the receiver by means of a motor-driven variable condenser to the antenna providing the stronger signal.

The coupling condenser, sold complete with its motor, consists of three plates, two stationary and one movable. One stationary plate is connected to the vertical antenna, the other to the horizontal antenna, while the movable plate is wired to the receiver's antenna terminal. As the signal in one antenna

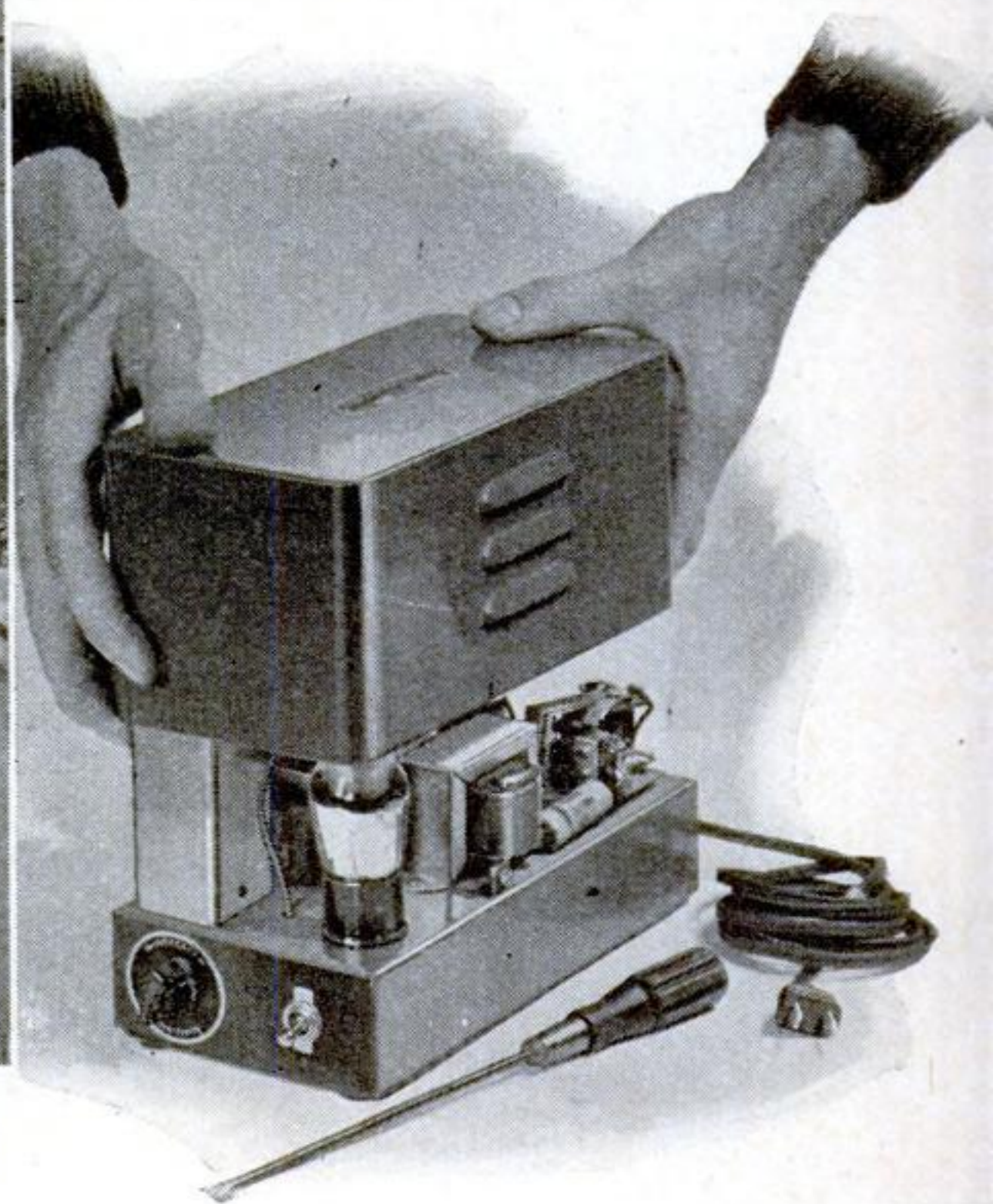
or the other fades, the movable plate is turned automatically to a new position. Thus, the antenna receiving the stronger signal becomes "capacity coupled" to the receiver in direct proportion to the signal strength.

Three tubes are used in the coupler circuit, a 6B8G amplifier, a 2A4G control tube, and a 25Z6 rectifier. The 2A4G, the heart of the circuit, acts as a sensitive relay to control the tiny magnetic motor that operates the dual coupling condenser. When the signal fades, this tube allows current to flow to the motor until the condenser has been adjusted to the new

By ARTHUR C. MILLER



All connections must be soldered carefully, and a metal shield, as at the right, must be used to eliminate radio interference

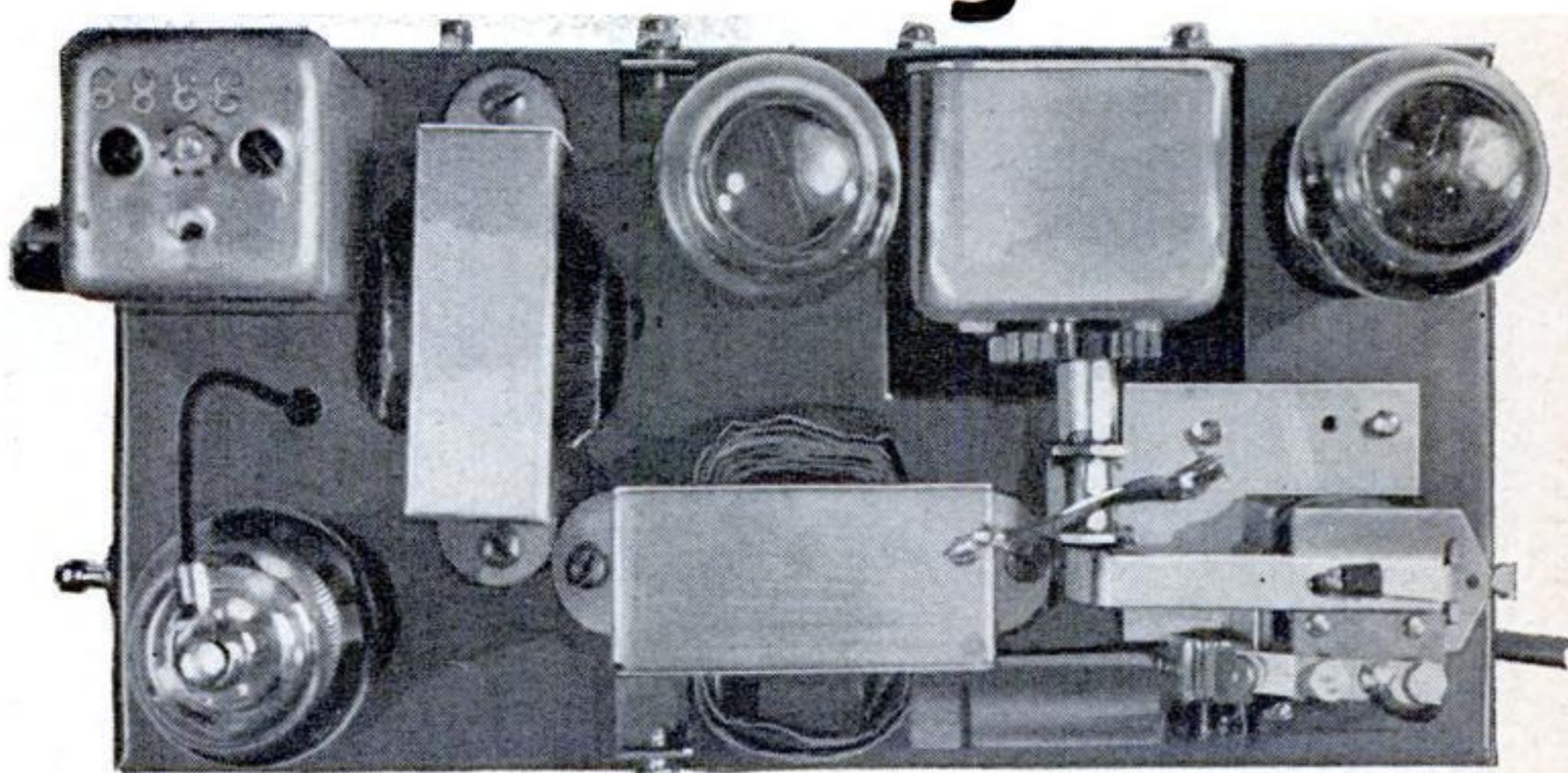


Kills Radio Fading

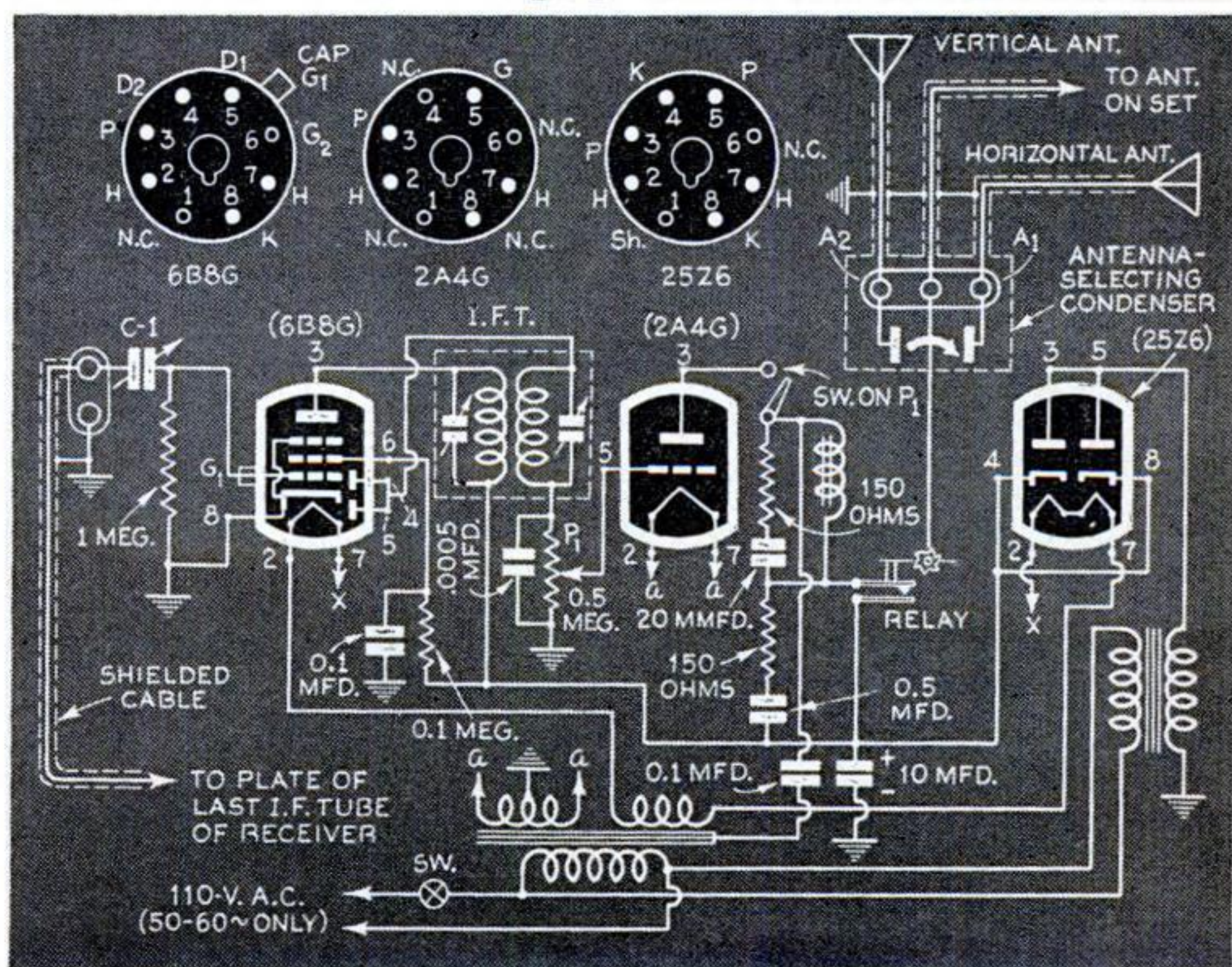
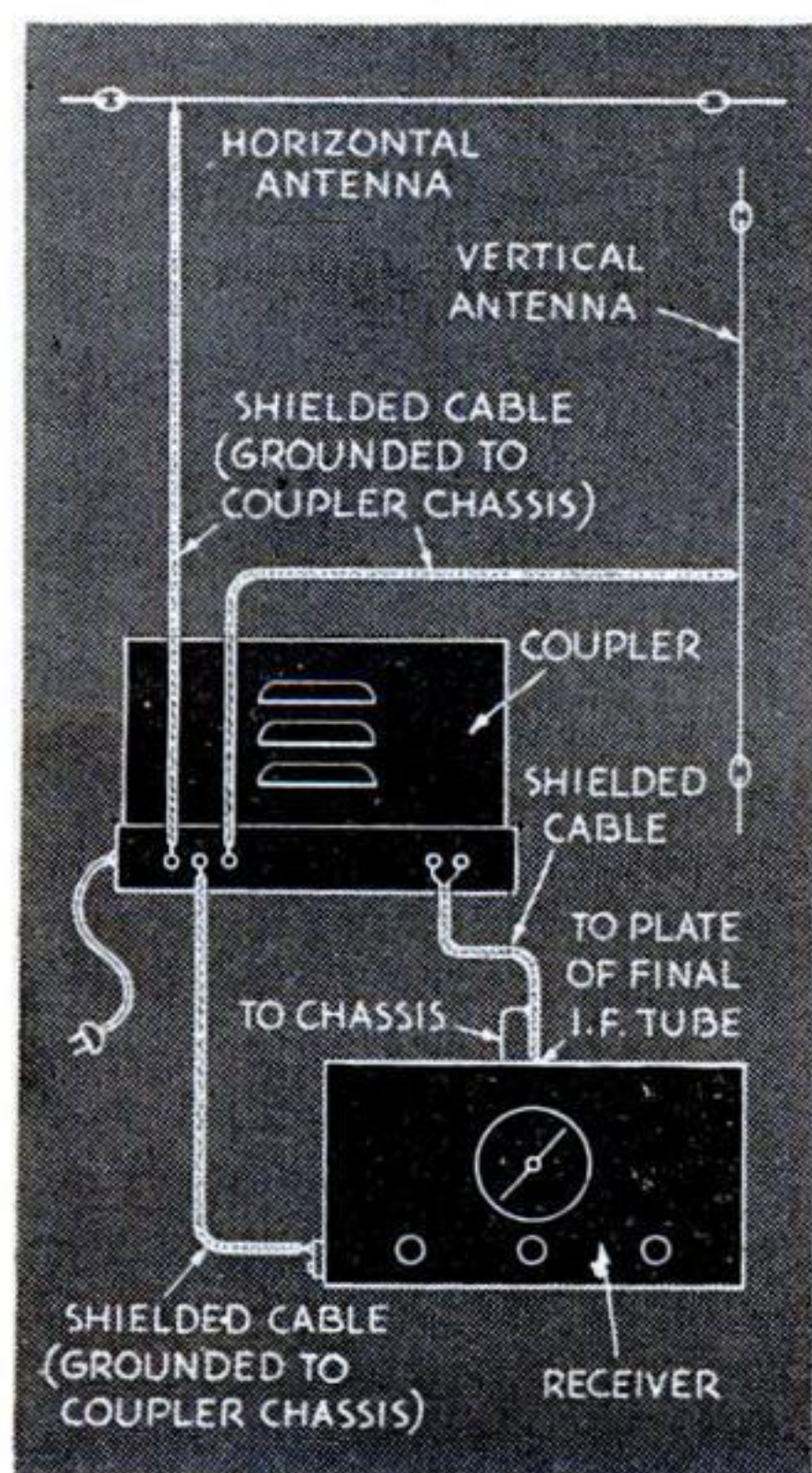
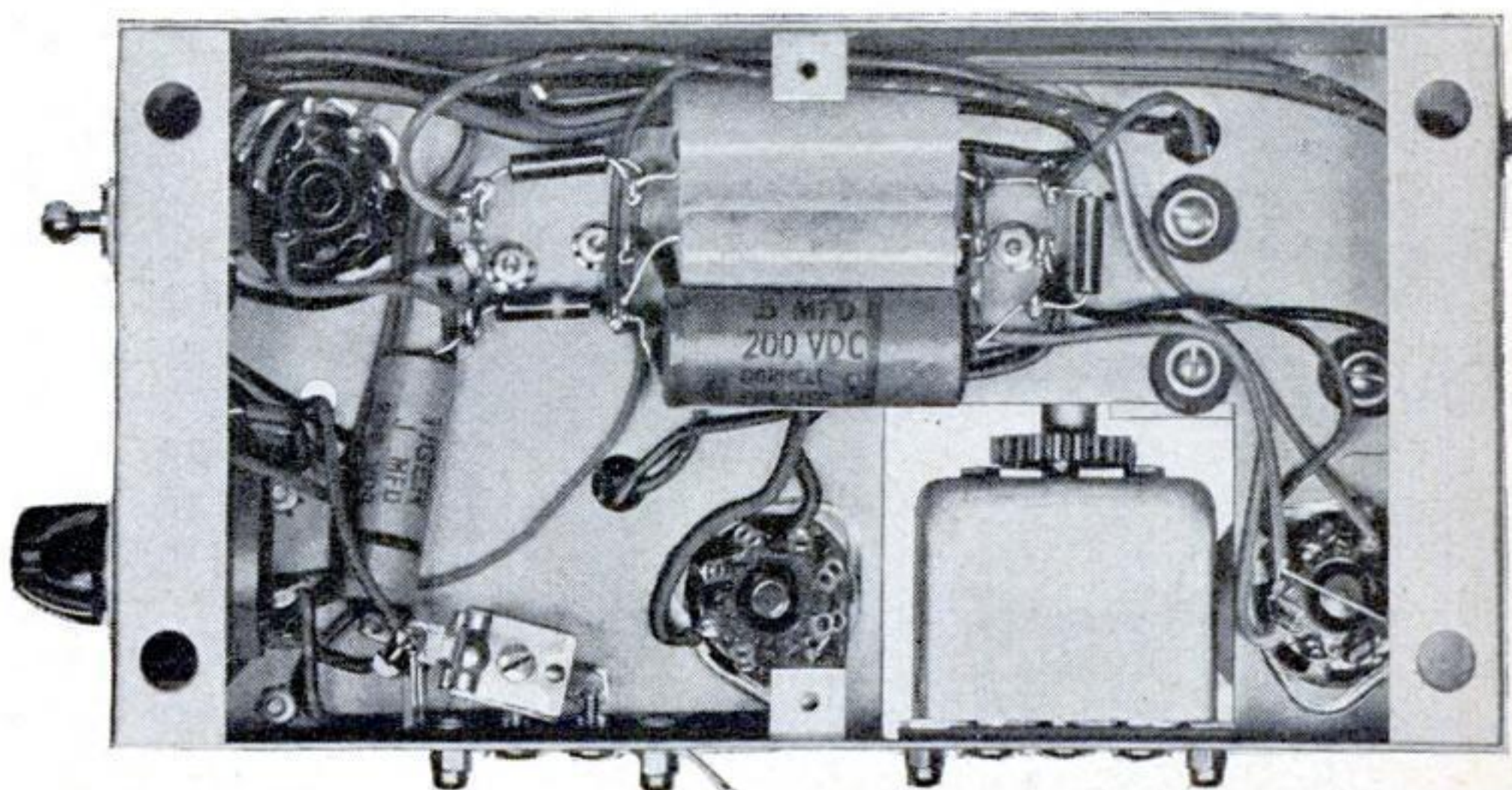
setting for maximum signal strength. The action is entirely automatic, and so swift that audible signal strength is constant.

In wiring the circuit, follow the diagram carefully. Make sure that all connections are well soldered, since any poor joints will cause losses that will completely upset the balance of the hook-up. When connecting the coupler to your receiver, use shielded cable and ground the outer sheathing as indicated. Shielded cable also should be used for the antenna lead-ins. A wafer adapter can be used to make the necessary connection to the plate prong of the receiver's last intermediate-frequency tube, as shown in the diagram.

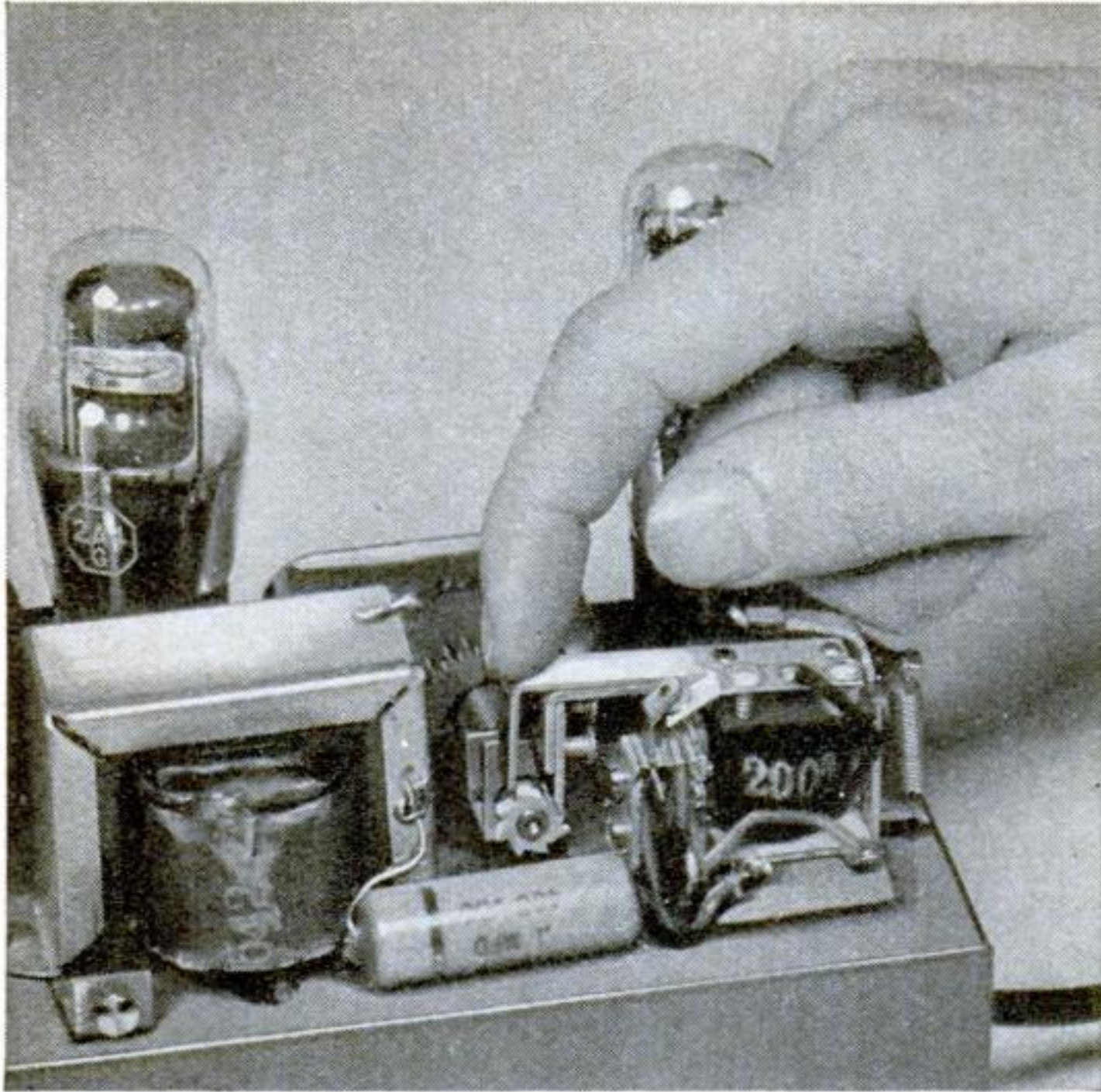
To adjust the coupler, tune in a short-wave signal which is fading, as indicated by the rise and fall in volume, or by the fluctua-



How the various parts are arranged above and below the metal chassis. The tiny motor, which turns the dual condenser to tune in the antenna giving the strong signal, is on the top face of the chassis



These drawings show how the coupler is connected to receiver and antennas, and the complete wiring diagram



A close-up of the motor that turns the dual condenser

tions of the visible tuning meter if the set is equipped with one. Then advance the sensitivity control or 500,000-ohm potentiometer until the signal remains constant. Do not turn the control too far or the motor will tend to operate continuously. It is best to adjust it to a point just below that of maximum response. The best point can be permanently marked on the dial with a pencil.

Some experimenting may be necessary in placing the two antennas for best results.

LIST OF PARTS FOR RADIO-FADING ELIMINATOR

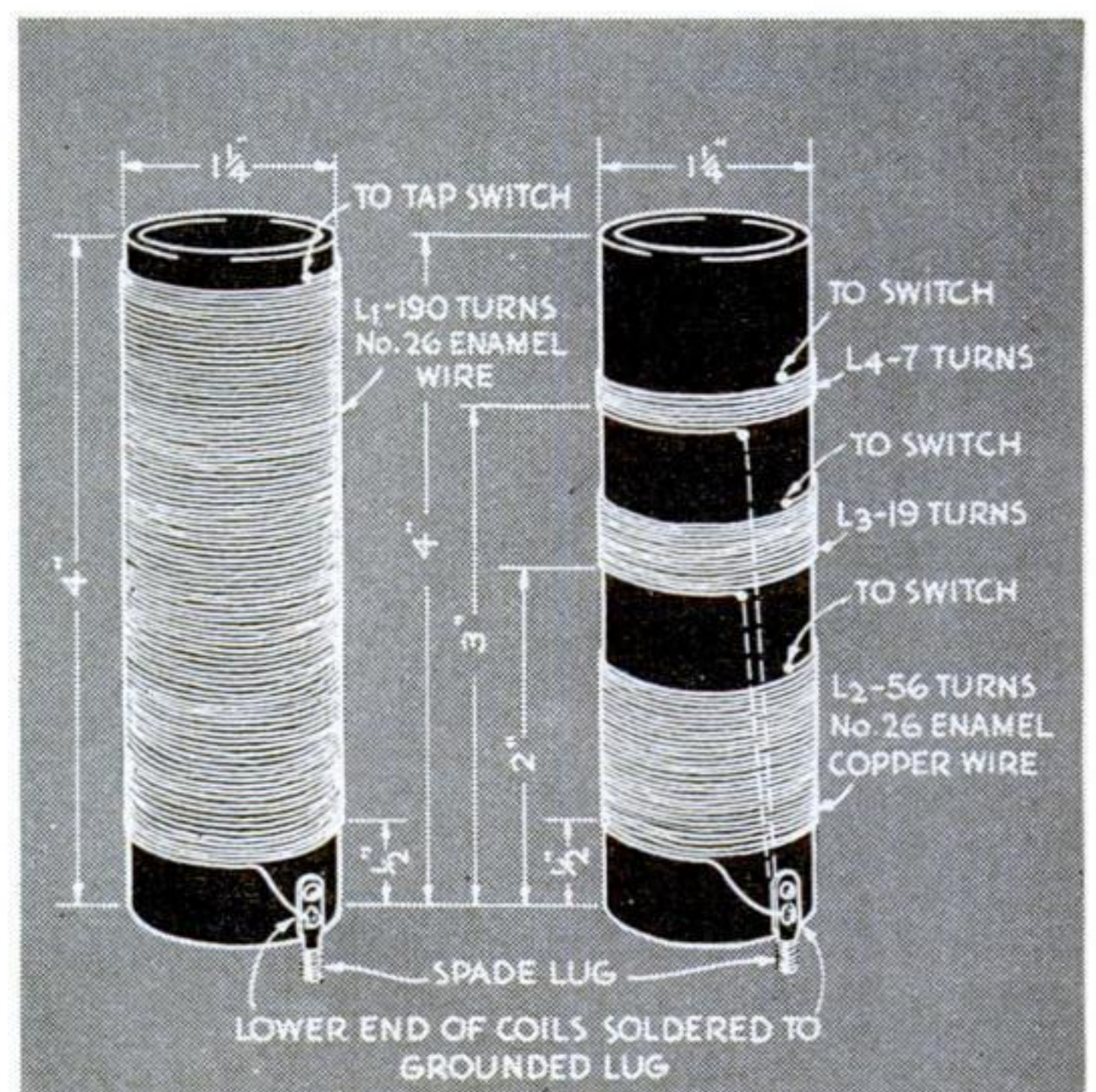
Antenna - selecting condenser, and motor.
Plate transformer.
Filament transformer.
Intermediate - frequency transformer, 455 Kc.
Trimmer condenser (C-1).
Condenser, 10 mfd., 300 volt.
Fixed condenser, 20 mmfd.
Tubular condenser, .5 mfd., 200 volt.
Tubular condenser, .1 mfd., 200 volt.
Tubular condenser, .1 mfd., 400 volt.
Mica condenser, .0005 mfd.
Two resistors, 150 ohm, $\frac{1}{2}$ watt.
Resistor, 1 meg., $\frac{1}{2}$ watt.
Resistor, 100,000 ohm, $\frac{1}{2}$ watt.
Volume control (500,000 ohm) with switch.
6B8G tube.
2A4G tube.
25Z6 tube.
Three octal sockets.
Toggle on-off switch.
Special chassis with cover and bottom plate.
Miscellaneous:—Nuts, clips, washers, lugs, wire, etc.

ALL-WAVE

HERE is an inexpensive alternating or direct-current receiver that covers all the wave bands from 430 to 10,000 kilocycles. It is of the regenerative type, but the functions of regeneration and detection are separate. Regeneration is furnished by a 6C5 tube and is controlled independently of the 6J7 detector tube, while the output tube, a 25L6, provides ample power for a 6-inch dynamic speaker, as well as earphones.

Contributing to the low cost of the set are the four tuning coils (L_1 , L_2 , L_3 , and L_4), which you can wind yourself with No. 26, enameled-copper wire, on tubing $1\frac{1}{4}$ inches in diameter. Three of these coils (L_2 , L_3 , and L_4) are wound on one form as shown in the diagram below. The only coil you need buy is a universal-wound inductance coil (L_5) used to tune the circuit to the very long wave bands. It may have any inductance value from 2.5 to 60 millihenries. A tap switch instantly selects the coil for the wave length desired. It should be noted that the lower end of the coil (L_5) goes to the cathode of the 6C5 tube instead of being grounded to the chassis. Plate voltage, and consequently the regeneration, of the 6C5 tube, is controlled by a .25-megohm potentiometer.

As a safeguard, a "polarized" plug is used on the power cord. One blade of the plug is slightly wider than the other for easy identification. When first plugging it into the outlet to be used with the set, take a 10-watt lamp and test to see if there is current flowing between the set chassis and a grounded



Follow these specifications in winding the coils

RECEIVER for Radio Amateurs

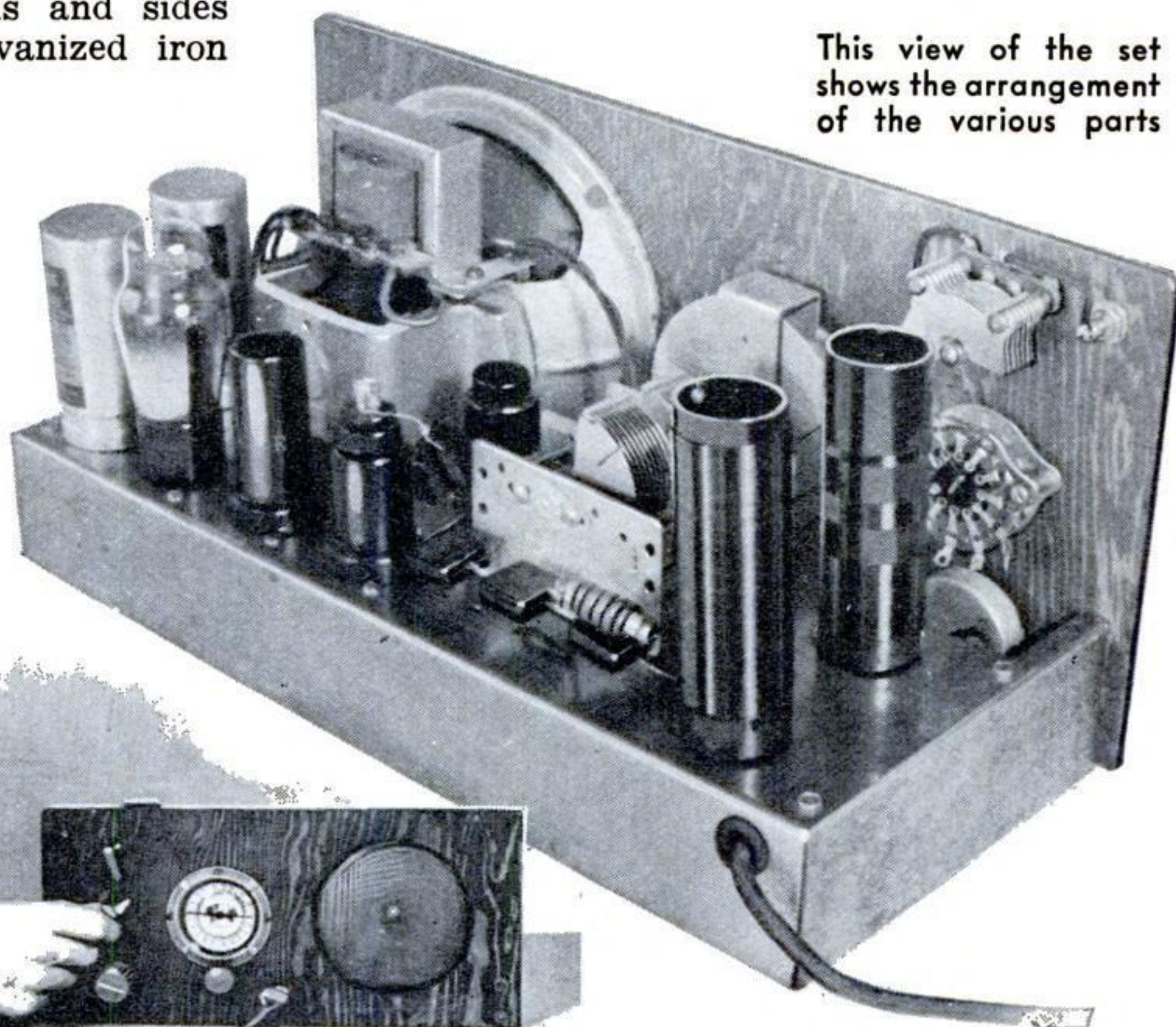
wire. If there is, reverse the leads of the polarized plug. Thereafter, when the plug is inserted in the outlet in the same position, a solid ground connection to the chassis will entail no danger of a shock or a short.

The 1/4-inch plywood panel measures 7 by 14 1/2 inches, and the chassis and sides are cut from 18-gauge galvanized iron

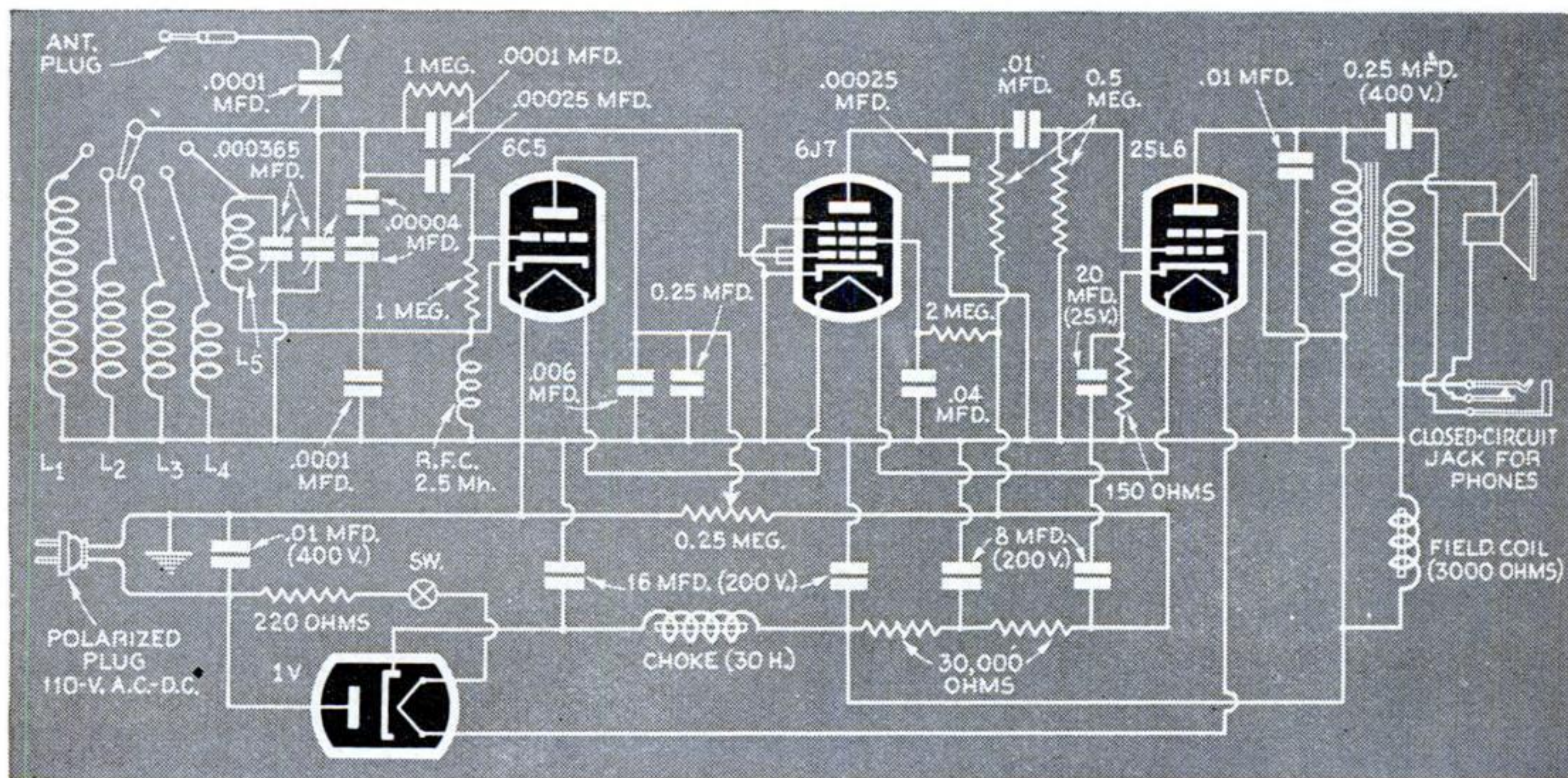
By
GUY FOREST

or cold-rolled sheet steel, and bolted together. A 50 to 150-foot antenna, with the antenna coupling condenser set near maximum capacity, will work best for the longer wave bands. On the short waves, an aerial wire from 5 to 25 feet long can be used.

This view of the set shows the arrangement of the various parts



**You can switch from earphones to
loudspeaker on any wave band**

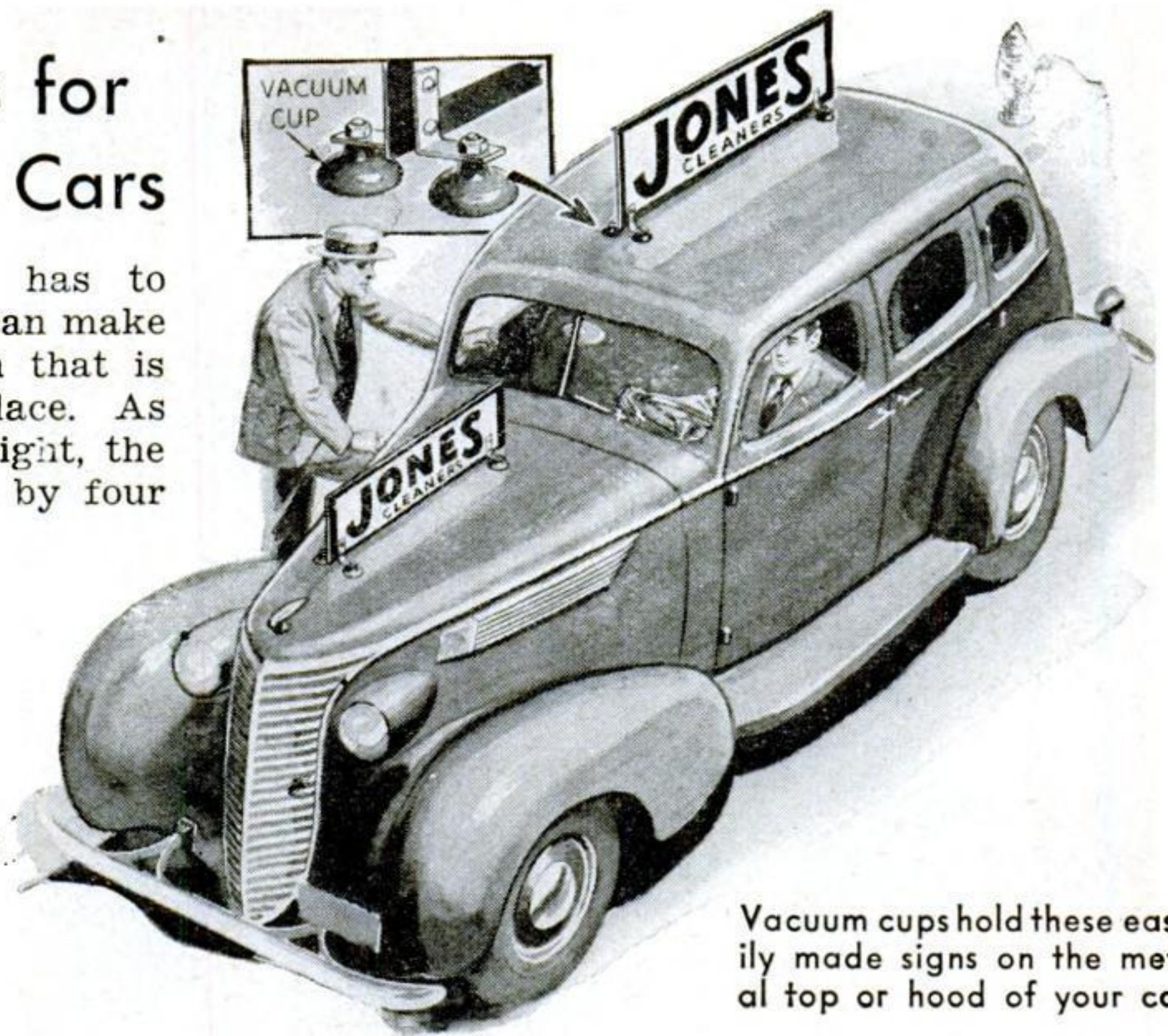


Two novel features of the hook-up are the polarized power plug, and the use of a separate tube for regeneration

Stunts for Car Owners

Removable Signs for Business-Pleasure Cars

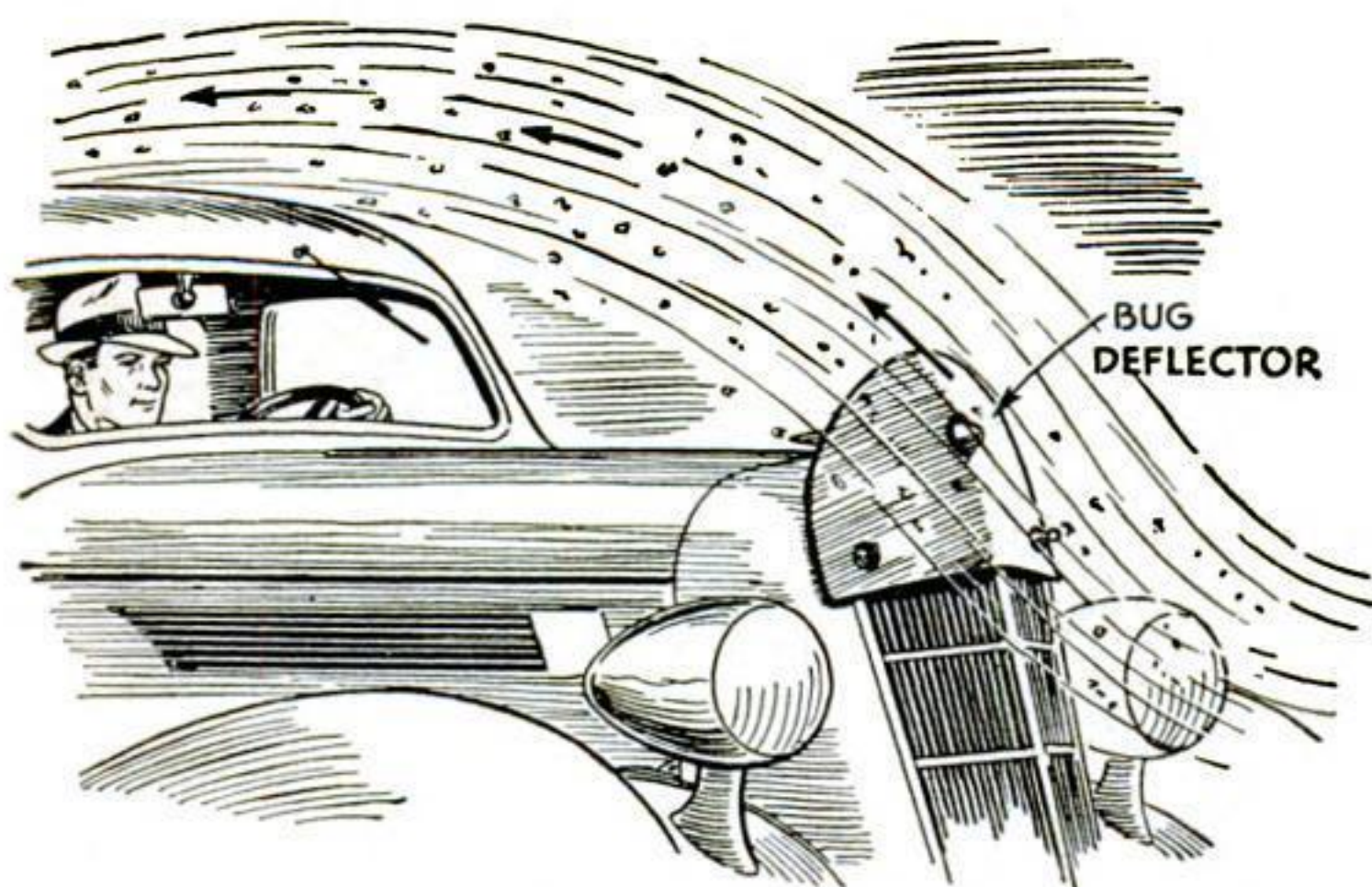
IF YOUR family automobile has to double as a business car, you can make an inexpensive advertising sign that is easy to remove or put into place. As shown in the drawings at the right, the advertisement is held in place by four vacuum cups bolted to angle irons which in turn are riveted to the rectangle of sheet metal that forms the painted sign. The signs can be stuck to the metal top of your car or to the hood. For best results the vacuum cups should be moistened before they are pressed into place. If the sign is parallel to the center line of the car, the effect of wind resistance is negligible.—A. H. W.



Vacuum cups hold these easily made signs on the metal top or hood of your car

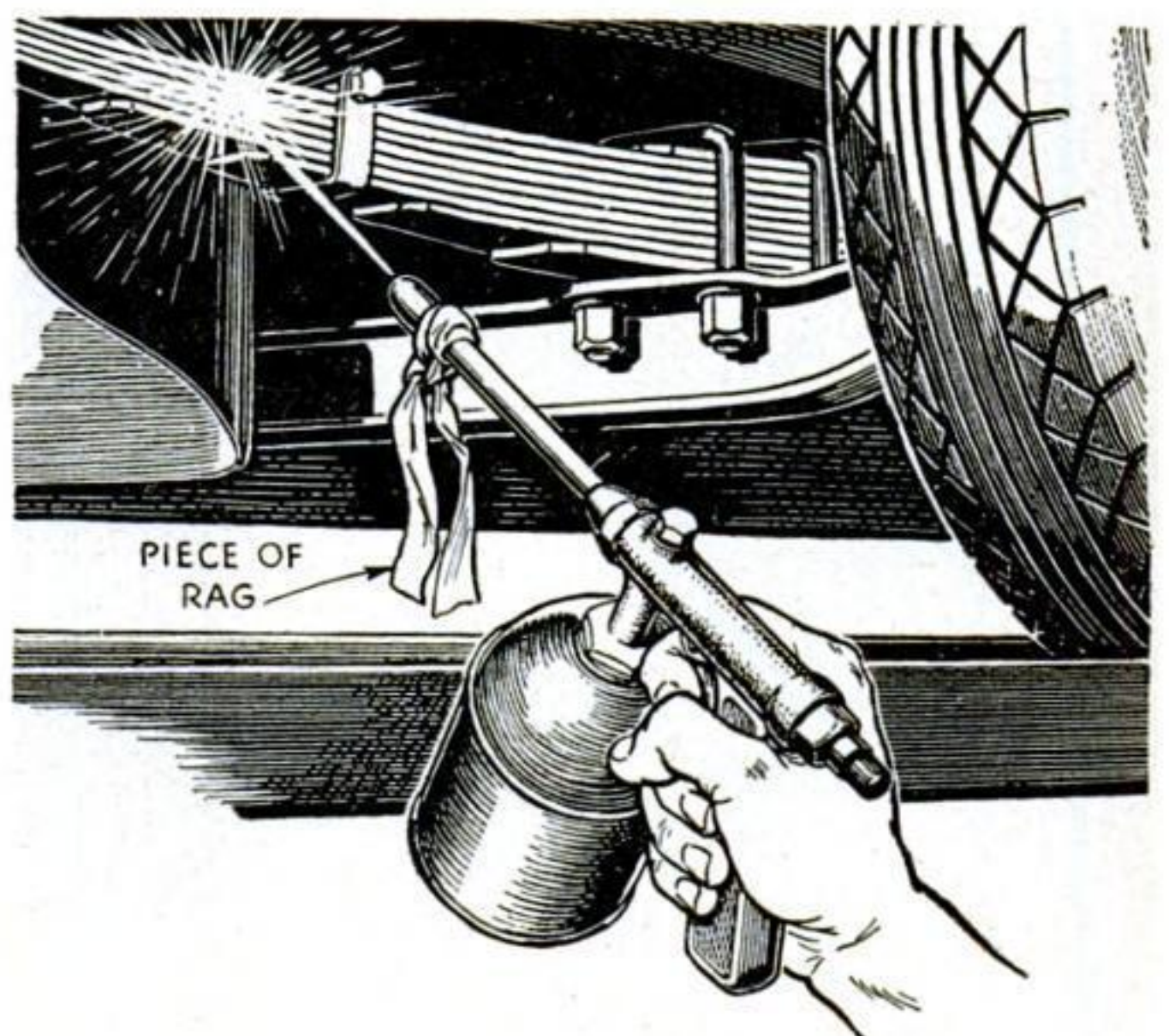
Rag on Oil-Gun Nozzle Collects Drippings

PRESSURE-TYPE oil-spray guns sometimes have an annoying way of collecting oil around the nozzle. The oil runs down the barrel of the gun to the reservoir, making the tool messy and slippery to handle. I solved the problem by tying a piece of rag around the barrel of the gun just below the nozzle. It acts like a wick to soak up the oil and keep it from running any farther back toward the reservoir.—S. R.



Homemade Bug Deflector Keeps Windshield Clean

BUGS can be more than just something to slap at when you're out driving in warm weather. They can dirty up a car's windshield in no time, particularly at night. I cut a bug shield out of sheet metal, shaped as shown, and fastened it on the radiator grille of my car, extending about four inches above its top—not high enough to interfere with road visibility. Bugs that strike it are deflected, and the flow of air it creates turns aside many more that would otherwise hit the windshield. The deflector can be removed when it is not needed.—R. B.

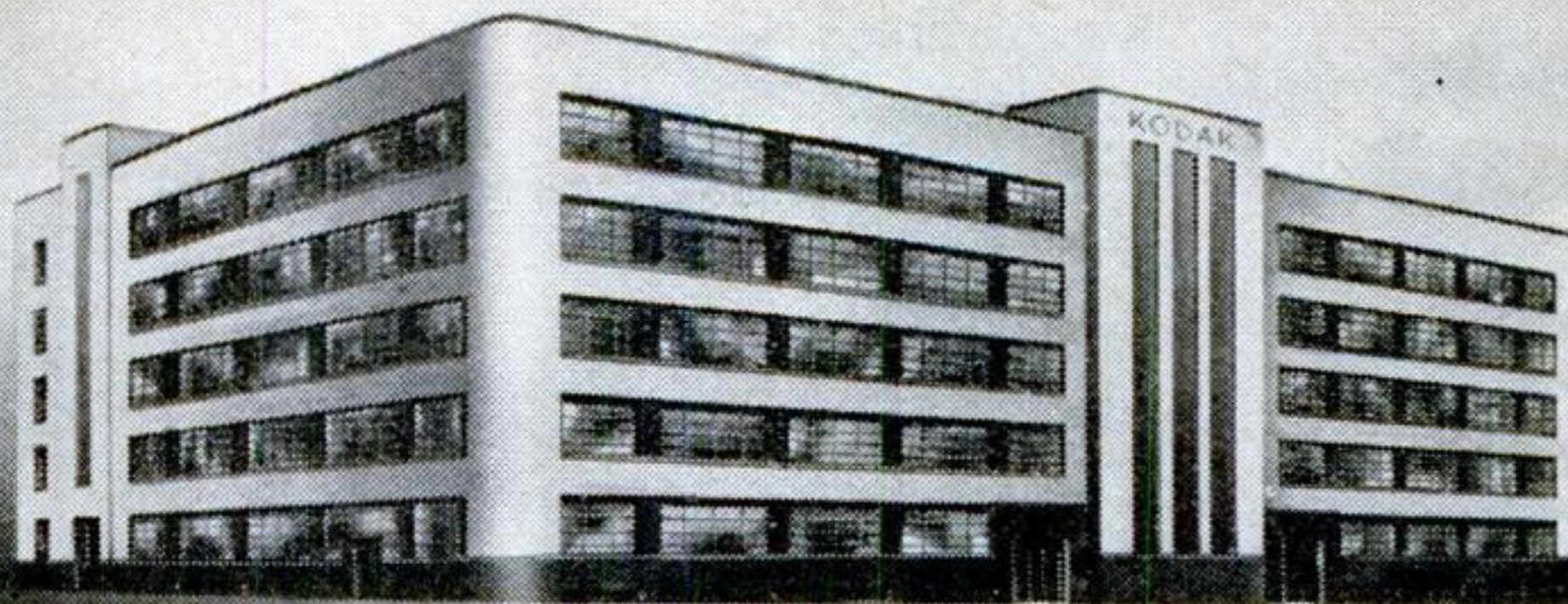


KODAK

PRICES

SHARPLY

REDUCED



New Eastman Plant, extensive addition to camera factory already the largest in the world, as it will appear when completed. Here will be produced the finest precision cameras, made by the largest group of American craftsmen ever assembled in the photographic industry.

Building an addition to the world's largest camera works means substantial savings on practically entire 1939 Kodak line

IT SEEMS that all America is making pictures. Wherever you go, you see more and more people carrying cameras. To meet this present greatly increased camera demand—and with an eye to the future—Eastman is now building an addition to the largest camera works in the world.

Facilities never known before will cut manufacturing costs. In a sweeping reduction, Kodak prices are now brought in line with these lower production costs to come. These savings to you apply on the newest and most popular models of the 1939 Kodak line. And they come to you in time to be ready for this year of World's Fairs and

unusual vacation opportunities—the greatest picture-taking year to date.

Own a brilliant, versatile, modern camera, Eastman quality throughout, at a price much lower than you expected to pay. See your Kodak dealer now . . . Eastman Kodak Company, Rochester, N. Y.

Going to the New York World's Fair?

Be sure to take your Kodak. Stop at the Kodak Building, where Eastman experts will advise you what to take and how to take it. And there you'll see the unique and gorgeous Cavalcade of Color—the *Greatest Photographic Show on Earth*. Nothing like it has ever been seen before. Don't miss it.

EXAMPLES OF THE PRICE REDUCTIONS

KODAKS	WAS	NOW
Kodak Junior Six-20, Series II, Single lens	\$8.75	\$7.75
Kodak Junior Six-20, Series II, Bimat lens	11.00	10.00
Kodak Junior Six-16, Series II, Single lens	10.25	9.25
Kodak Junior Six-16, Series II, Bimat lens	12.75	11.50
Kodak Senior Six-20, K. A. f.7.7 lens . .	17.00	15.00
Kodak Senior Six-20, K. A. f.6.3 lens, Diomatic shutter	21.00	19.00
Kodak Senior Six-20, K. A. f.4.5 lens . .	28.00	25.00
Kodak Senior Six-16, K. A. f.7.7 lens . .	19.50	17.50
Kodak Senior Six-16, K. A. f.6.3 lens, Diomatic shutter	24.50	22.50
Kodak Senior Six-16, K. A. f.4.5 lens . .	32.00	29.00

MINIATURES	WAS	NOW
Kodak Bantam, K. A. f.6.3 lens	\$9.50	\$8.50
Kodak Bantam, K. A. f.5.6 lens	16.50	14.00
Kodak Bantam, K. A. Special f.4.5 lens . .	27.50	22.50
Kodak 35, K. A. f.5.6 lens	18.50	14.50
Kodak 35, K. A. f.4.5 lens	29.50	24.50
Kodak 35, K. A. Special f.3.5 lens	39.50	33.50
Kodak Duo Six-20, Series II, K. A. f.3.5 lens (Compur-Rapid shutter) . . .	57.50	52.50
Kodak Retina II, Anastigmat f.2.0 lens, Compur-Rapid shutter (with field case)	140.00	120.00
CINÉ-KODAKS		
Ciné-Kodak Eight, Model 20, f.3.5	32.50	29.50
Ciné-Kodak, Model K, f.1.9 (without case)	88.50	80.00

Be sure to see your Kodak dealer about these remarkable price reductions.

"Sure Keeps Models RUNNING FINE!"

NEEDS
JUST A
FEW
DROPS



MOBIL HANDY OIL

A light, penetrating, non-gumming oil that is excellent for scale models. Lubricates all electric appliances, sewing and washing machines, bicycles, toys. Fine for automobile generators. Prevents rust. Convenient wall bracket free with every can.



QUIETS CAR ENGINES

MOBIL UPPERLUBE

Add to your gasoline—reaches the engine as a vapor. Protects upper cylinder walls, piston rings and valve stems from internal rust and scuffing wear. Reduces carbon.

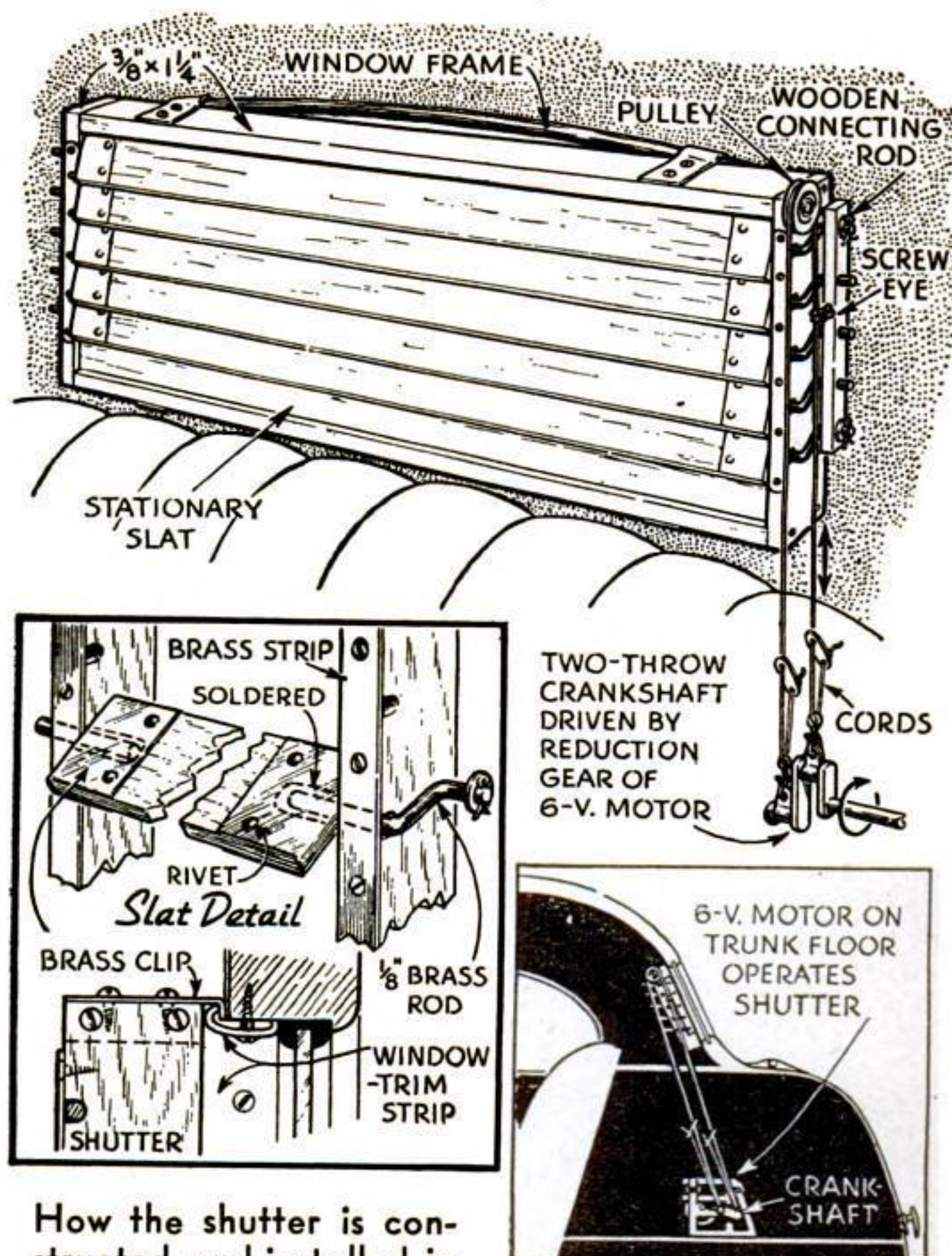
Buy where you buy Mobiloil or Mobilgas

Mobil Specialties

MOBILGLOSS · MOBILWAX · MOBIL STOP-LEAK
MOBIL HANDY OIL · MOBIL RADIATOR FLUSH
MOBIL WINDOW SPRAY · MOBIL UPPERLUBE
MOBIL HYDROTONE · MOBIL SPOT REMOVER



BY THE MAKERS OF MOBIL OIL



How the shutter is constructed and installed in the rear-window frame

Rear Car-Window Shutter Operates Electrically

TO BLOCK OUT distracting sunlight in the daytime, or the headlights of following cars at night, I built the electrically operated rear-window shutter illustrated above, which is controlled by a button near the driver's seat. Three-eighths by 1 1/4-inch material was used for a wood framework that was clamped to the window frame. Venetian-blind slats serve as shutters. At the end of each slat I attached a brass clip having a 1/8-inch crank soldered to it. Notches were made in the frame, the slats laid in, and a brass strip screwed on the frame edge to hold the slats in place. A wooden connecting rod ties all the slat cranks together, making them all act as one. Cords fastened to the center of this connecting rod lead to a motor installed in the car trunk compartment directly below the rear window. I used an old six-volt motor and reduction gear once employed to operate a furnace damper. The cords are attached to a double crank connected to the reduction gear. Bowsers on the cords serve to take up the slack. Pressing a dashboard push button starts the motor, and the shutter slats can be stopped at any position by releasing the control button at the proper moment, as they keep opening and closing as long as the push button is held down.—F. R. S.

...plenty of **VELVET**
and plenty of time
*best vacation for
man and pipe*



*Better
smoking
tobacco*

Velvet

- for **MILDNESS**
fine old
Kentucky Burley
aged in wood
- the **FLAVOR**
of pure maple
sugar for extra
good taste

*Velvet packs easy in a pipe
Rolls smooth in a cigarette
Better tobacco
for both*

Copyright 1939, LIGGETT & MYERS TOBACCO CO.

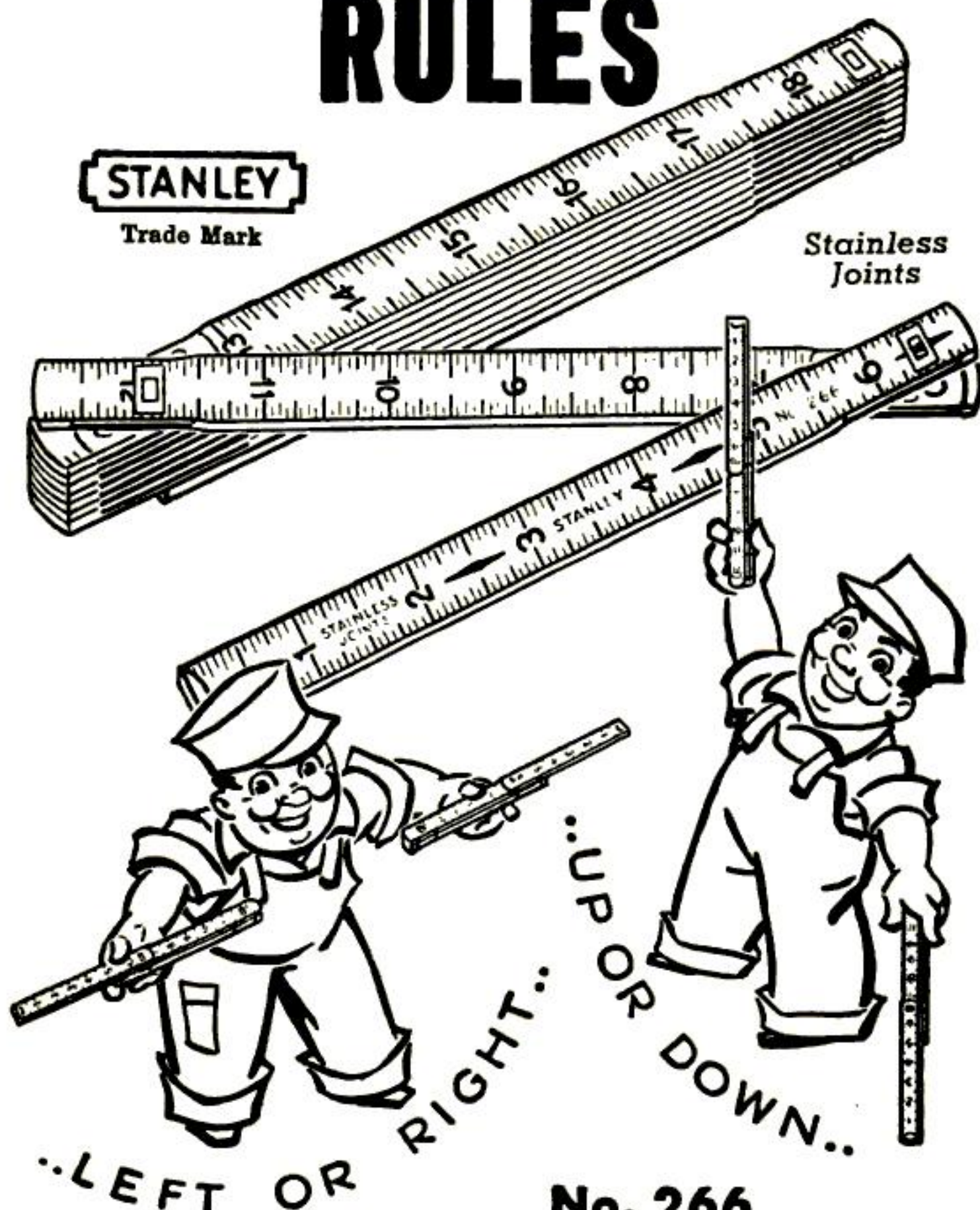
JULY, 1939

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207

STANLEY

EASY TO READ RULES



No. 266

Stanley "Zig-Zag" Rule
With Vertical Figures
Easiest of all folding rules
to read. 6 foot.

In 1850 the first Stanley Rule was made. Eighty-nine years of research and development have built a preference for Stanley Rules among all types of craftsmen who appreciate quality and design.

The two rules shown here are outstanding in that they combine finest quality with an unmatched ease of reading. They are but two of scores of practical Stanley Rules all described in Stanley Tool Catalog No. 34. Write for your free copy.

No. 6386

Stanley "Pull-Push" Rule
Direct Reading

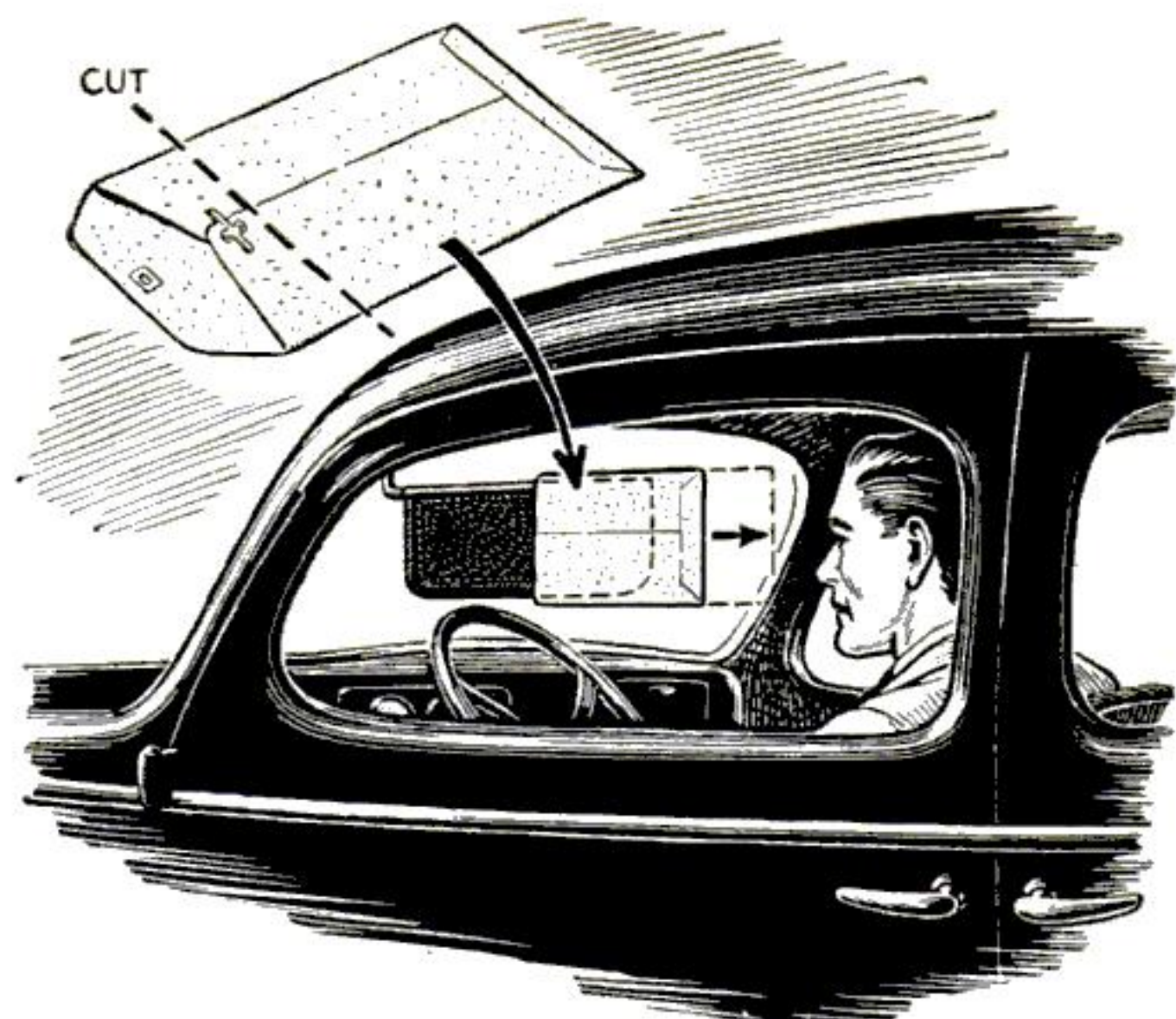
Black and white blade—you can almost read it in the dark. 6 ft. flexible-rigid blade

Red indicator on case points to exact inside measurement . . . no guesswork.



STANLEY TOOLS

Division of The Stanley Works, 106 Elm St., New Britain, Conn.



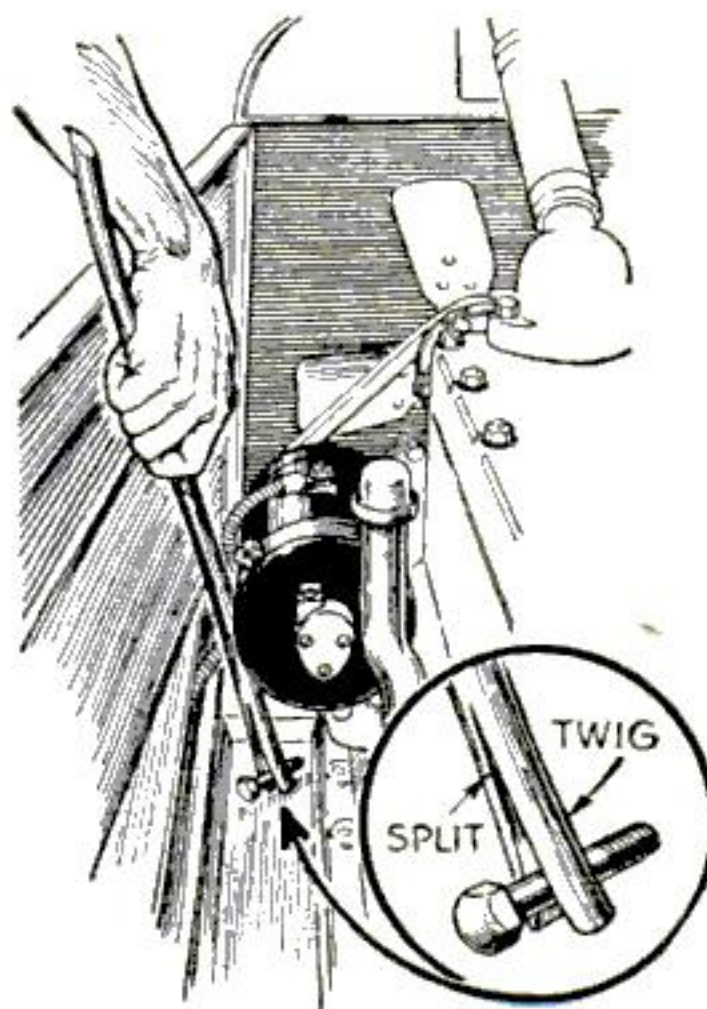
Mailing Envelope Makes Sunshade Extension

WHEN driving at an oblique angle toward the sun, so that its rays streamed in the side window, I found that the sunshade on my car, when swung into position, was not long enough to shield my eyes. This meant that I had to lean forward in an uncomfortable position to avoid the sun. To overcome this, I lengthened the shade by cutting out a paper sleeve from one end of a mailing envelope. This is slipped over the end of the sunshade so that it may be pulled out as an extension to the right length for keeping the sun off my face. When not needed, the extension telescopes back over the sunshade, where it is inconspicuous and does not interfere with the regular use of the device, and at the same time is ready for service.—W. C. L.

Split Stick Retrieves Bolts Dropped in Pan

SOMETIMES the simplest ways to do things around a car are the last ones thought of.

I've often struggled to retrieve a bolt or nut that dropped down beside the motor of my car, but recently I stumbled on an easy and effective method. Merely split the end of a twig and use it as a long-handled clothespin to grab and lift the elusive part, as shown in the drawing at the left.—L. M.



CHAMPION SPARKING PLUGS

МOTORНИ СВЪЩИ ШАМПИОНЪ

CHAMPION SUÜTEKÜÜNAL

ဘုံအိမ်ကန် "ပျံအိမ်ကန်"

BOUGIE CHAMPION

CANDELE CHAMPION

CHAMPION SVEČU

CHAMPION BUJILERI

ချန်ပီယံ ဗီးပလပ်

CHAMPION ZÜNDKERZE

チャンピオン、スパークプラグ

CHAMPION SPARK PLUGS

משעמפין ספארק פלאגס

CHAMPION TENDPLUGGER

CHAMPION SYTYTYS-TULPPA

SWIECA ZAPLONOWA CHAMPION

BUJIAS CHAMPION

ΜΠΟΥΖΙ ΤΣΑΜΠΙΟΝ

CHAMPION TÄNDSTIFT

VELA CHAMPION

ZAPALOVACI SVICKA CHAMPION

香檳撲六

CHAMPION



* If you are curious about the identity of these various foreign languages, write the Champion Spark Plug Co., 901 Upton Ave., Toledo, O., and an identifying sheet will be sent you.

Symbol of Better Engine Performance in *ANY* language

Wherever modern internal combustion engines are engaged in serving humanity, either on highways, waterways or airways, on the farms, in the homes or in industry, Champions are recognized and preferred for the better performance they exact from every engine. Now Sillment-sealed against troublesome gas or compression leakage, common to ordinary spark plugs, new Champions with their exclusive Sillimanite insulators set *new* and *unequaled* performance standards.

ACTUAL SIZE V-PLUG



MODEL BUILDERS—ATTENTION!

Specially designed for model gas engines giving the same dependable performance as regular Champions. Absolutely gas-tight, alloy needle point electrode, one-piece construction. If not available through your dealer, write Champion Spark Plug Company, 901 Upton Ave., Toledo, Ohio.

V-3/8" 24 Thread
V-2 1/4" 32 Thread
65c

IT'S THRIFTY TO INSTALL NEW SPARK PLUGS—Demand CHAMPIONS

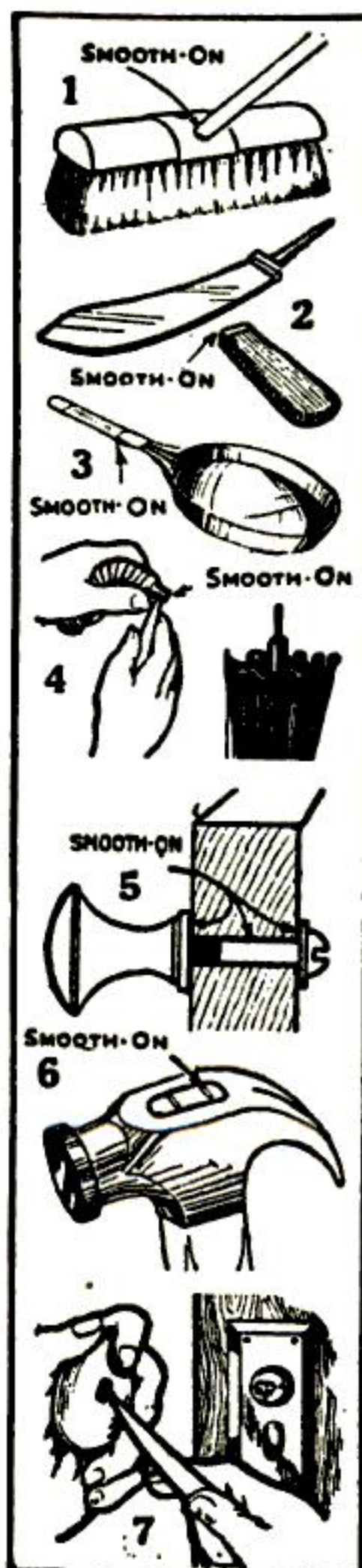
LOOSE HANDLES QUICKLY MADE TIGHT

MIX a little Smooth-On No. 1 into a putty, put this into the opening, force the parts together, and in a few minutes the metallizing of the Smooth-On produces *lasting* tightness. Such repairs cost only several cents each and save the many dollars otherwise spent for renewals that are no better.

In addition to quick effective replacement of loose handles and knobs as suggested in the sketches, Smooth-On No. 1 enables you to stop leaks at cracks and joints in steam pipes, radiators and boilers, in water pipes and tanks, in gas pipes, in automobile radiators, engine water jackets, hose connections and in gasoline and oil lines, to make loose bolts, nuts, screws, etc., permanently tight.

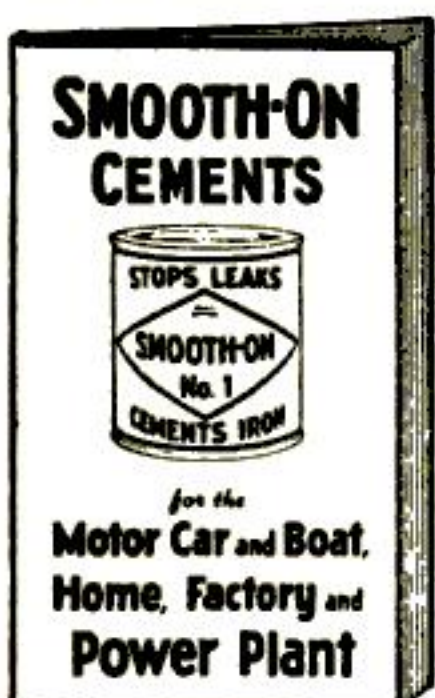
Smooth-On No. 1 after set and metallized holds water, steam, gasoline, oil, etc., under any pressure, and may be applied with equal success to any metal. It is also used for anchoring and taking up looseness, and holds in masonry, tiled walls, slate, wood, etc.

By doing your own household and automobile repairing with Smooth-On No. 1, all the Smooth-On repairs you make in a year, will probably cost you less than any one of them made by a professional mechanic—and you will be surprised at the ease of application and the number of places where Smooth-On can save money.

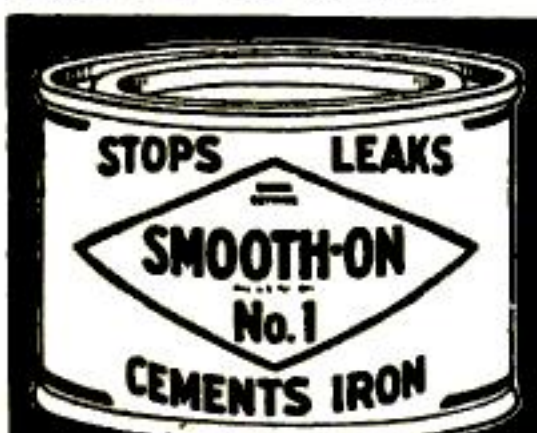


Keep a can of Smooth-On No. 1 in your tool box and be ready for emergencies. Do your own repairing and at the end of the year, you will find that your efforts have been handsomely rewarded. The free Smooth-On Repair Book gives full instructions.

Get Smooth-On No. 1 in 7 oz., 1-lb. or 5-lb. tins at nearest hardware store or if necessary direct from us.



Mail coupon for
FREE BOOK



SMOOTH-ON MFG. CO.,
574 Communipaw Ave.,
Dept. 58, Jersey City, N. J.
Please send the free Smooth-On
Repair Book.

Name.....

Address.....

7-39

Do it with **SMOOTH-ON**

Designed for easy transportation,
this boat is made in two sections




WORKSHOP PLANS for Summer Projects


WHEN building boats, furniture, models, or other articles in your workshop, you will find that accurate, detailed blueprints simplify the work considerably. For seventeen years we have provided readers with authoritative drawings for many projects at a nominal cost, and this service has grown to be the greatest of its kind.

Pictured above is a sectional rowboat built from blueprints Nos. 340-341-R, costing 75 cents. Some of our boat plans are given below; and an illustrated chart will be sent free upon receipt of a stamped and self-addressed envelope. If you are interested in other types of projects, ask for our complete blueprint list.

BOATS

	Cabin Cruiser, 17' long, weighs 750 lb., for use with outboard or inboard drive, 356-357-358-359-R.....	\$1.50
	Folding Duck Boat, 13' long, 170-R.....	.50
	High-Speed Boat for Small Outboard Motors, 7'11" long, 257-R.....	.50
	Midget Boat or Pram, 9' long, for oars, sail, or outboard motor, 339-R.....	.50
	Motorboat-Rowboat, 13' long, with decked hull, for use with outboard or inboard drives and oars, 147-R.....	.50
	Racing Sailboat BLACKCAT, 13'4" long, weighs 250 lb., Marconi rigged, 321-322-323-R.....	1.00
	Sectional Rowboat, 9' 8" long; can be used with small outboard, 340-341-R.....	.75
	Skiff, 13' 9" long, 4' 7" beam, weight 225 lb., for 1 to 16 h.p. outboard motors; can be rowed, 363-R.....	.50
	Sport Runabout, 9'8" long, for small outboard motors, weighs 100 lb., 309-310-R.....	.75
	Utility Rowboat, 13' long; can also be sailed or driven by outboard motor, 224-R.....	.50

MODELS

	Brig MALEK ADHEL, 20" hull, frame-and-plank or solid-hull construction, 304-305-306-R.....	1.25
	Clipper Ship in a Bottle, 121-122.....	.50
	Clipper Ship SOVEREIGN OF THE SEAS, 20 1/2" hull, 51-52-53-R.....	1.00
	Cody Coach, 13" long, 144-145-146-R.....	1.00
	CONSTITUTION ("Old Ironsides"), 21" hull, 57-58-59-R.....	1.00
	Cruiser U.S.S. INDIANAPOLIS, 12" long, 216.....	.25
	Farragut's Flagship HARTFORD, 33 1/2" hull, 221-222-R.....	1.50

(Continued on page 212)

ANOTHER

Chrysler "FIRST!"

... Superfinished surfaces
accurate to millionths of an inch!



Superfinish is the reason why owners say, "The 1939 Chrysler is the greatest car ever built!"

CHRYSLER never was satisfied with the amount of wear in operating parts. Chrysler has "ground," "honed" and "lapped." (See diagram above.)

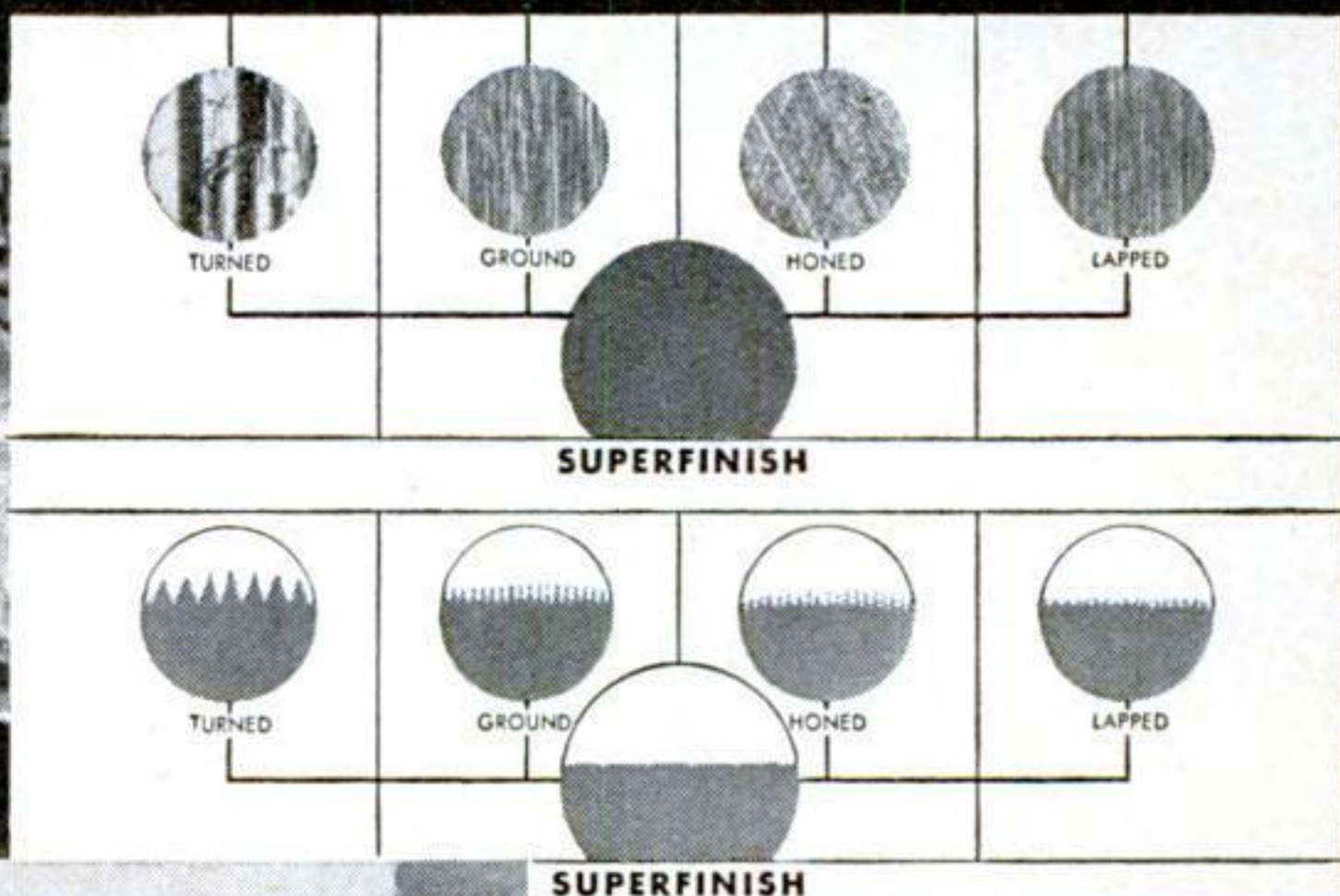
But still, operating surfaces had to be "worn down"... there was always roughness in a new motor.

So Chrysler research got busy...and the result is Superfinish.

"What is Superfinish?" you ask. Well, in simplest terms, it is a new science which can make metal surfaces smooth to as little as one-millionth of an inch.

That is so smooth that new instruments of microscopic measurement, operating on the standard of a microinch—which makes one inch equal to 16 miles—had to be invented to discover any kind of unevenness.

Superfinish now makes metal surfaces so smooth that the



UPPER CHART: PHOTOMICROGRAPH OF FLAT SURFACES IN VARIOUS FINISHES.
LOWER CHART: DRAWING OF MAGNIFIED PROFILE VIEWS OF VARIOUS FINISHES.

SURFACES SO SMOOTH THEY CLING TOGETHER!

"fuzz" of metallic points and jagged edges which were left by the finest and most costly of precision methods are now eliminated.

Instead of working against one another, like files rubbed together, operating surfaces now glide on a perfect film of oil on a perfect surface.

The original close fit of the parts is maintained. Smoothness and quietness are scientifically assured. Theoretically, if properly lubricated, Chrysler Super-

finished parts should never wear out...but Chrysler doesn't claim *that* miracle.

Chrysler does assure you that Superfinish adds years to the life of its engine...reduces upkeep costs...assures smoothness and quietness for tens of thousands of extra miles.

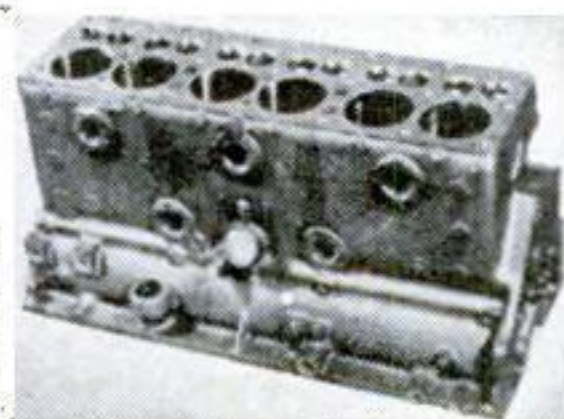
You may be interested in a handsome, illustrated book on this new science, and an attractive pocket piece; one side as smooth as commercial grinding could make it, the other Superfinished to the smoothness of glass. Just write to Chrysler Sales Corporation, Detroit.

FOR LONG LIFE

Buy Chrysler!

CYLINDER BORES
PISTONS

VALVE STEMS



BRAKE DRUM AND SHOE



CRANK-SHAFT
CAMSHAFT

TAPPET HEAD

CLUTCH FACE



**PULL OVER
TO THAT GROCERY
STORE, BUDDY! YOU CAN
CLEAN OUT THAT RADIATOR
FOR 10¢ WITH
SANI-FLUSH!**



Rust, scale and sediment accumulate in the delicate veins of a car radiator. Water circulates poorly. The car overheats. Power is lost. And you may be heading for expensive trouble.

You can clean out your car radiator with Sani-Flush for 10c (25c for the largest trucks and tractors). It's easy to do yourself. Pour in Sani-Flush. Run the engine. Drain, flush and refill with clean water (*directions on the can*). Or, if you prefer, have your garage or service station use Sani-Flush to do the job. It cannot injure the motor or fittings. You'll find Sani-Flush in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 25c and 10c sizes. The Hygienic Products Company, Canton, Ohio.

Sani-Flush *Safe* NOT CAUSTIC
KEEPS RADIATORS CLEAN

**BRINGS OLD FRIENDS
TOGETHER**



● Holds permanently on china, glass, wood, metal, leather, paper, fabrics. Transparent, flexible, waterproof—not affected by heat. Dries quickly. Ideal for model making as well as for mending.



DUCO CEMENT

Plans for Your Workshop

(Continued from page 210)

New Bedford Whaleboat, with complete equipment, 14" long, 326-R.....	.50
Old Naval Gun, a six-pounder in battery; gun is 7½" long; 9" by 11½" overall, 352.....	.25
Privateer SWALLOW, a Baltimore Clipper, 13" hull, 228-229-230-R.....	1.00
Racing Yacht, 20" Marconi-rigged sailing model, 48-R.....	.50
Spanish Treasure Galleon, 24" long, 46-47.....	.50
Trading Schooner, 17½" hull, 252-253.....	.50
U. S. Battleship TEXAS, 3' hull, 197-198-199-200....	1.00
Viking Ship, 20½" long, 61-62-R.....	.75

[Construction kits are available for some of these models. Turn to page 214]

FURNITURE



Colonial Writing Desk, Governor Winthrop style, 3'6" high and 3'8" long, 21	.25
Combination Bench and Tilt-Top Table, (no turning), 11.....	.25
Gate-Leg Table, 3'6" diameter, circular top with leaves up (no turning), 24.....	.25
Kitchen Table Cabinet, 27" by 48" top, has folding seat (no turning), 27.....	.25
Low Stand, Early American Style; also Cactus Plant Holder and Metal Candle Stand, 361A.....	.25
Modernistic Stand (24¾" high) and Bookcase (70½" high), 88.....	.25
Sewing Cabinet of 1812, 178A.....	.50
Small Early Colonial Pine Chest, 32" long, 21" deep, 24" high, 308A.....	.25
Tavern Table and Scroll Mirror, 105.....	.25
Telephone Table and Stool, 18.....	.25
Tilt-Top Table, 20" by 24" top, 249A.....	.25



RADIO

Amateur Short Wave Receiver, three tubes, battery or 110-volt A.C. or D.C. operation, 155.....	.25
Amplifier, Three Stage, 42.....	.25
Beginner's Battery Receiver, 365A.....	.25
Five Tube Short-Wave Set, midget receiver with loudspeaker, A.C. or D.C., 223.....	.25
One-Tube Receiver, battery operated, 103.....	.25
Screen Grid Receiver, 109.....	.25



MISCELLANEOUS

Automatic Lighthouse Night Lamp and Pelican Design Sewing Kit, 255A.....	.25
Bird and Animal Patterns, 56.....	.25
Electric Train, Horse, and Doll House, 14	.25
Indian Book Ends, Alligator Toy, and How to Cut Sheet-Metal Monograms, 360A.....	.25
Paddle-Wheel Magazine Rack, Ski Repairs, and Rack for Table-Tennis Paddles and Balls, 343A....	.25
Perpetual Star Chart, 214.....	.25
Sandpaper Cabinet, Saw Horse, Tool Rack, Hand-Screw Rack, and Machinist's Hand Vise, 368A....	.25
Six Simple Block Puzzles, 65.....	.25
Toy Lathe, Drill Press, Saw, and Jointer, 113.....	.25
Turned and Inlaid Buffet Set (bowl and pair of candlesticks), 307A.....	.25
Wood Mosaic Serving Tray and Novelty Wooden Book Ends, 297A.....	.25

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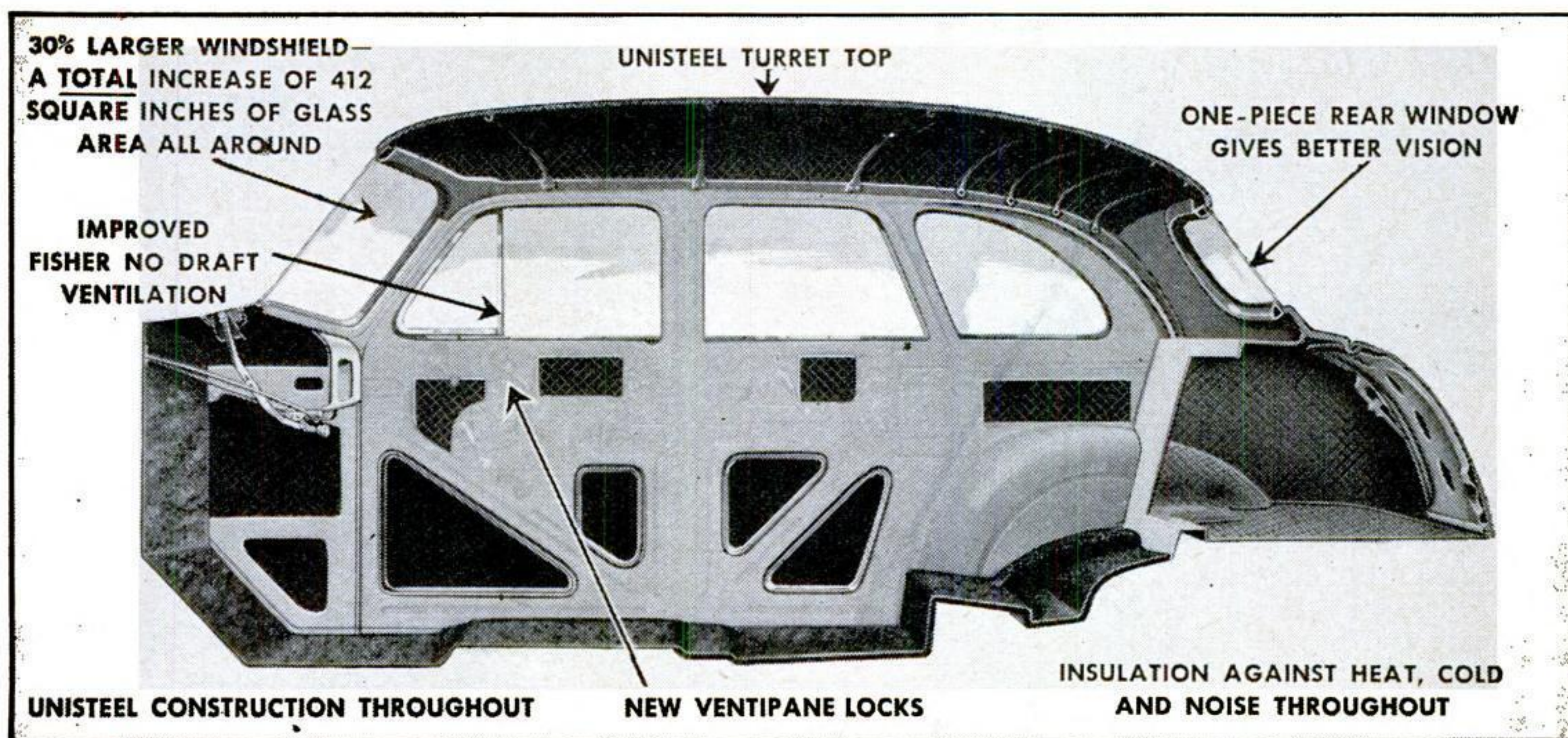
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FISHER FACTS



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IT'S not easy to make a motor car body comfortable for everybody—for short people and tall ones, for those who like lots of fresh air and those who prefer it in smaller quantities, for drivers and passengers who want more visibility.

But it can be done! Fisher engineers have certainly proved that.

Check the new Bodies by Fisher on the 1939 General Motors cars. Note, for example, that in the Series 70 & 80 Oldsmobile sedans there's an actual increase of 412 square inches in total window and windshield area . . . a 30% increase in glass area in the windshield alone.

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In these and in many other ways—with the silent, solid security of Unisteel construction—with wider seats and roomier interiors—the new Body by Fisher puts comfort on a "suit yourself" basis.

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NEW KIT CONTAINS MATERIALS FOR MAKING NINE MODELS OF U. S. Fighting Ships

OUR new construction kit No. 7M for making nine miniature models of the latest United States fighting ships will provide pleasant occupation for those summer evenings when you feel inclined to do a little light craftwork. No model-making experience and no special equipment are required. The essential tools are a penknife, razor blade, pliers, very small drill, and very small paintbrush.

The kit costs only \$1.50 and contains all the raw materials for making models of the superdreadnought *Washington* (7½" long), light cruiser *Philadelphia* (6"), aircraft carrier *Yorktown* (8"), destroyer flotilla leader *Winslow* (3¾"), four destroyers (3½"), and submarine *Pompano* (3"). A special model-maker's knife of tempered steel is included.

STANDARD SHIP MODEL KITS

- | | |
|---|---------|
| A. Whaling ship <i>WANDERER</i> , 20½" hull, 27" over all | \$7.40* |
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| L. Farragut's flagship <i>HARTFORD</i> , steam-and-sail sloop-of-war, 33½" hull, 41" over all | 8.45* |
| Q. Privateer <i>SWALLOW</i> , a Baltimore clipper, 12½" hull, 20" over all | 4.95† |
| V. Clipper <i>SOVEREIGN OF THE SEAS</i> , 20½" hull, 26" over all | 4.95† |
| Y. Trading schooner, Maine type; 17½" hull, 22½" over all | 4.90† |
| 2S. U.S. Navy destroyer <i>PRESTON</i> , 31½" long | 5.95* |
| 3S. <i>CONSTITUTION</i> ("Old Ironsides") 21" hull, 31" over all | 6.50* |
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(Continued on page 216)

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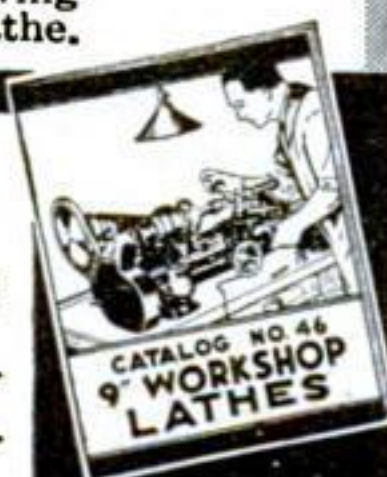
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Kits for Making Models

(Continued from page 214)

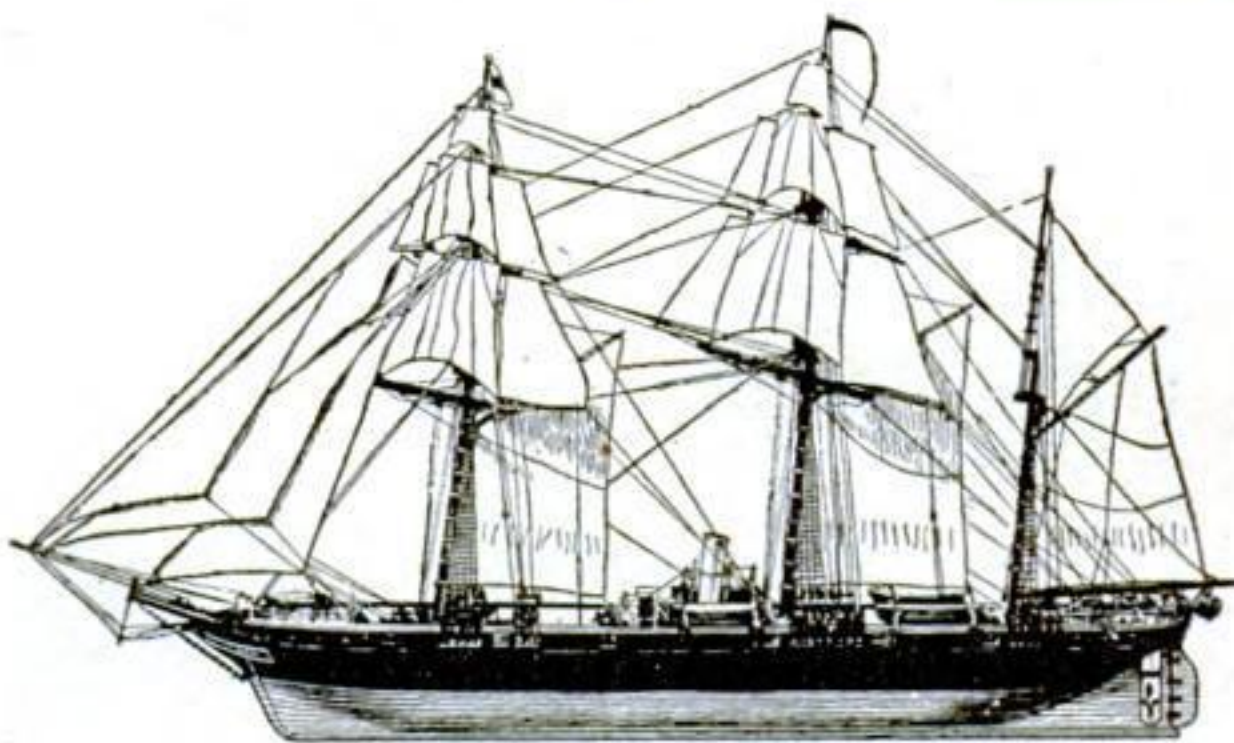
- 8S. Fishing schooner **BLUENOSE**, 17½" hull, 22" over all 4.95†
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- M. Aircraft carrier **SARATOGA**, 18" long..... 1.00
- N. Convoy of four U.S. destroyers, each 6¼" long .75
- R. U.S. cruiser **TUSCALOOSA**, 11¾" long..... 1.00
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Kit 10S—Confederate raider "Alabama"

- Z. H.M.S. **BOUNTY**, 8½" hull, 11½" overall..... 1.50
- 2M. Ocean freighter, 14" long..... 1.50
- 3M. Yacht **NOURMAHAL**, 8½" long..... 1.00
- 5M. Liner **PRESIDENT LINCOLN**, 14¾" long.... 1.50
- 6M. Fishing Schooner **WE'RE HERE** of "Captains Courageous," 9½" over all..... .75
- 7M. Fleet of nine modern U.S. fighting ships, including superdreadnought, light cruiser, aircraft carrier, submarine, and five destroyers; scale, 1" equals 100'..... 1.50†

MISCELLANEOUS

- 7. Whittling kit with two shaped blocks for making sea captain 5½" high..... 1.50
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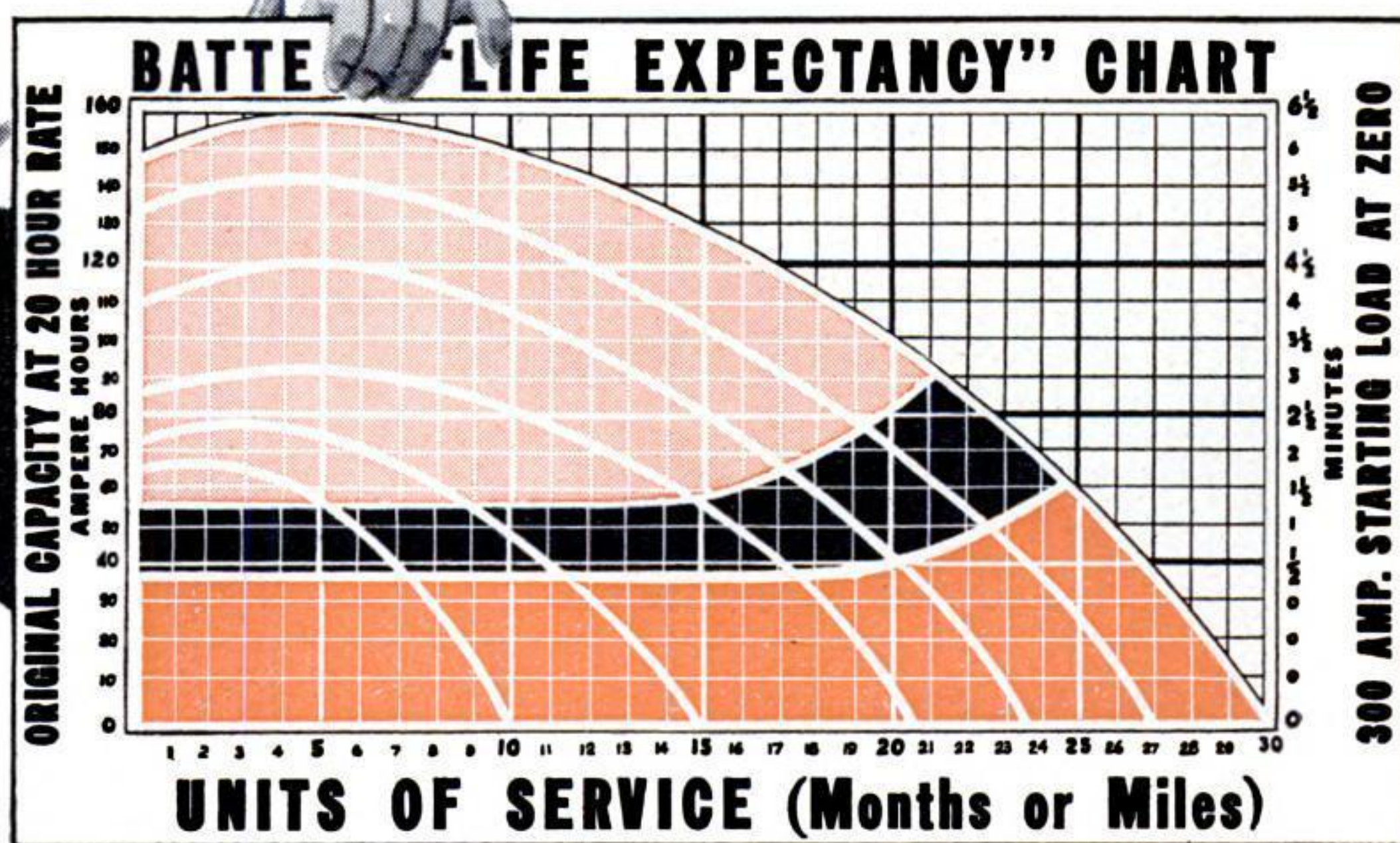
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from the life insurance companies



Now you can protect yourself against battery failure

You know what insurance actuary tables are like . . . the sheets that show the probable period of life remaining for people of various ages. The figures in these tables are averages, based on accurate statistics compiled throughout the years.

To make it possible for you to protect yourself against battery failure, the manufacturer of Delco batteries adopted this same principle in preparing the Battery "Life Expectancy" Chart. Information was gathered on thousands of batteries at various periods of service, and plotted into chart form to show at a glance the probable life left in a battery at any point of service.

For instance, if your battery is a 110-ampere-hour battery, you simply find that curve on the chart and follow it until it is intersected by the vertical line indicating the units of service the battery has given.

The chart then shows you at what point your battery enters the "uncertain zone" where it should be replaced, and at what point it enters the "danger zone" where it is likely to give out entirely any day.

Remember, the Battery "Life Expectancy" Chart is based on averages, which means it is correct in a great majority of cases. You can save yourself the annoyance and worry of battery failure by stopping at your Delco battery dealer's and checking your battery with him on the chart.

Delco batteries are built to meet the exacting demands of the manufacturers of all General Motors cars and trucks. As the preferred replacement battery, Delco provides sure starting power for all makes of cars.



Delco-Remy

ANDERSON, INDIANA

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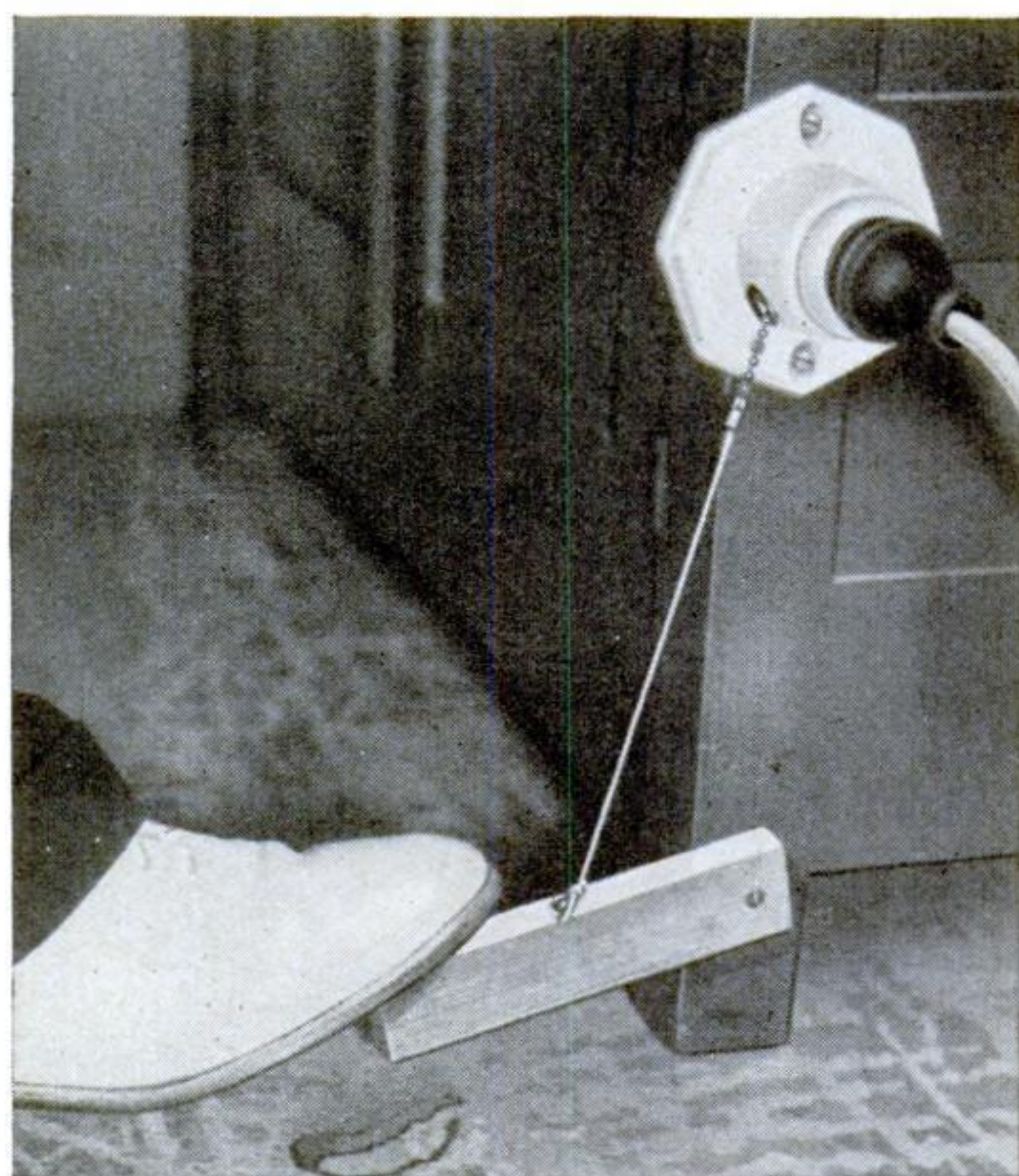


World's Largest Manufacturer of Automotive Electrical Equipment



Enlarger Lamp Controlled with Pull-Chain Socket

A SIMPLE type of enlarger switch may be rigged up by mounting a pull-chain electric socket near the bottom of the enlarging table as shown below. Beneath it fasten a piece of wood with a single screw to serve as the foot piece. Tie the socket chain to this treadle in such a way that a slight pressure of the foot will pull the cord. The enlarger lamp will then stay on until the treadle is pressed again. This enables the operator to relax when handling negatives that require a long time to print.—HAROLD A. SOARD.



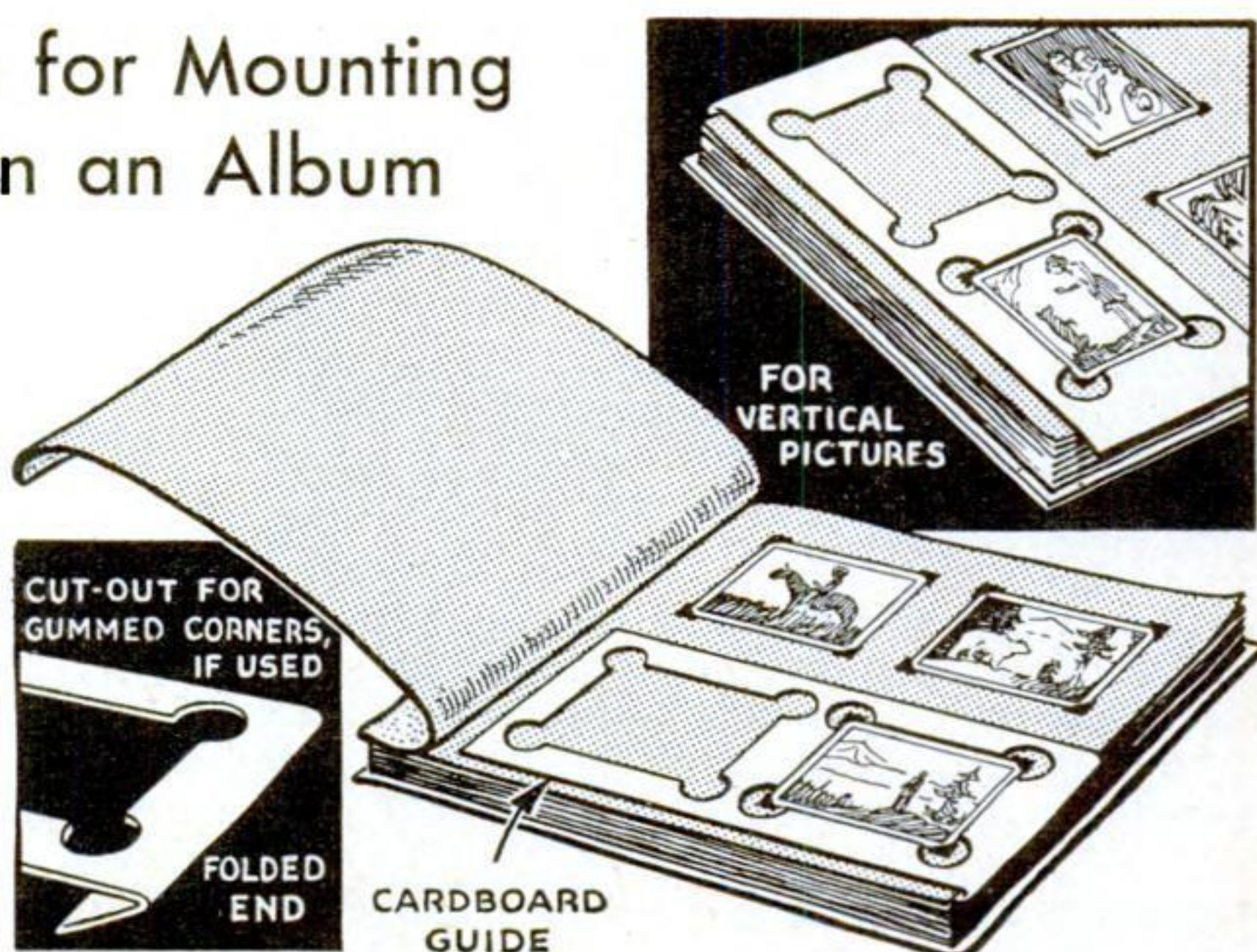
Pressing the treadle down lightly switches on the enlarger, and a second push turns off the current

Small Safe Light Is Aid in Adjusting Enlarger

THE difficulty of setting the lens aperture of an enlarger accurately in the dim light of the darkroom can be overcome by using an auxiliary light as illustrated above. For this purpose a small flash light of the fountain-pen type will serve. Simply cover the end with red crêpe paper and hold it in place with a rubber band.—O.B.

A Timesaving Guide for Mounting Photos Uniformly in an Album

PHOTOGRAPHS, if all the same size, may be mounted more uniformly and neatly in an album by using a guide cut from thin cardboard. One end is folded so it may be slipped over the edge of the page when the guide is used for mounting horizontal pictures. If gummed corners are used for fastening the pictures, cut out the corners of each opening in the mask as indicated to allow them to be placed without disturbing the guide.—M. G. WINTERTON.



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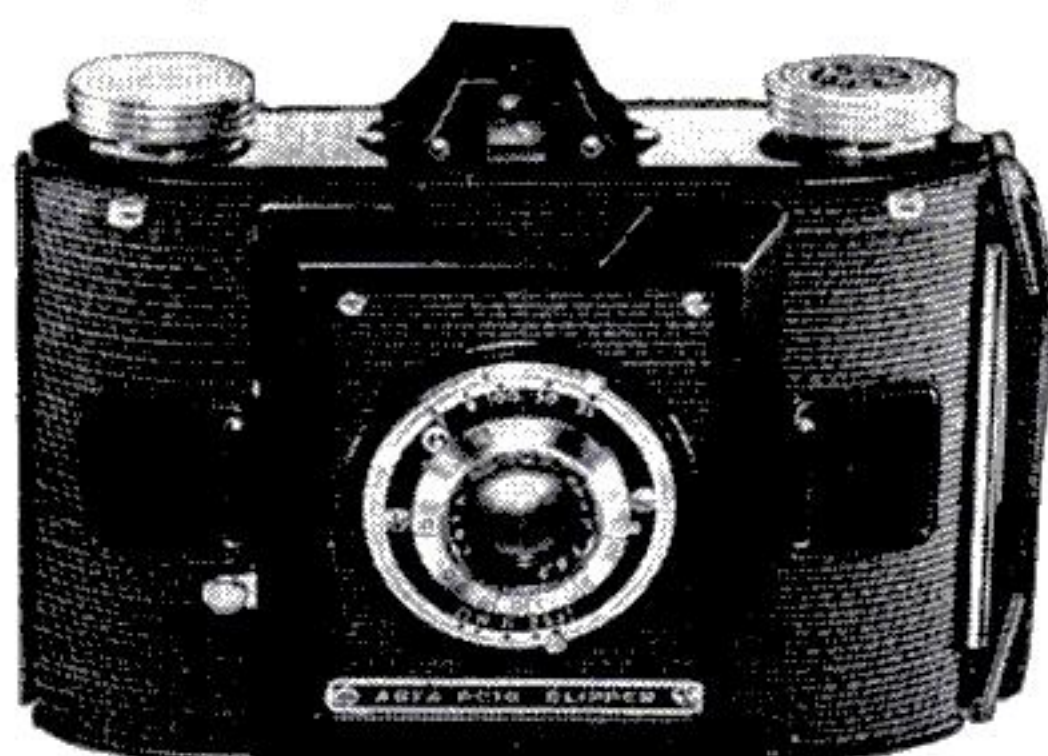
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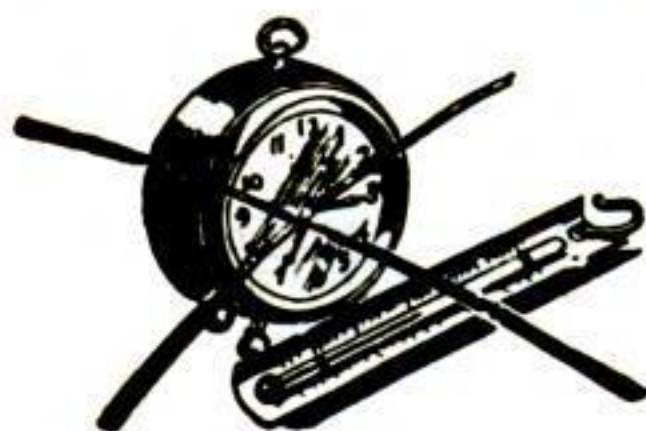
THE Agfa f6.3 Clipper Special features new telescoping front which eliminates bellows; shutter speeds of 1/25th to 1/100th second, bulb and time, hinged back, easy loading arrangement, shutter release guard, tripod socket, and built-in depth-of-field scale. Takes 15 pictures, (2 1/2 x 2 1/16) on one roll of PD16 (616) film. Complete with neckcord and lens cap, \$15.50. *Made by Agfa Ansco Corporation in Binghamton, New York, U.S.A.*

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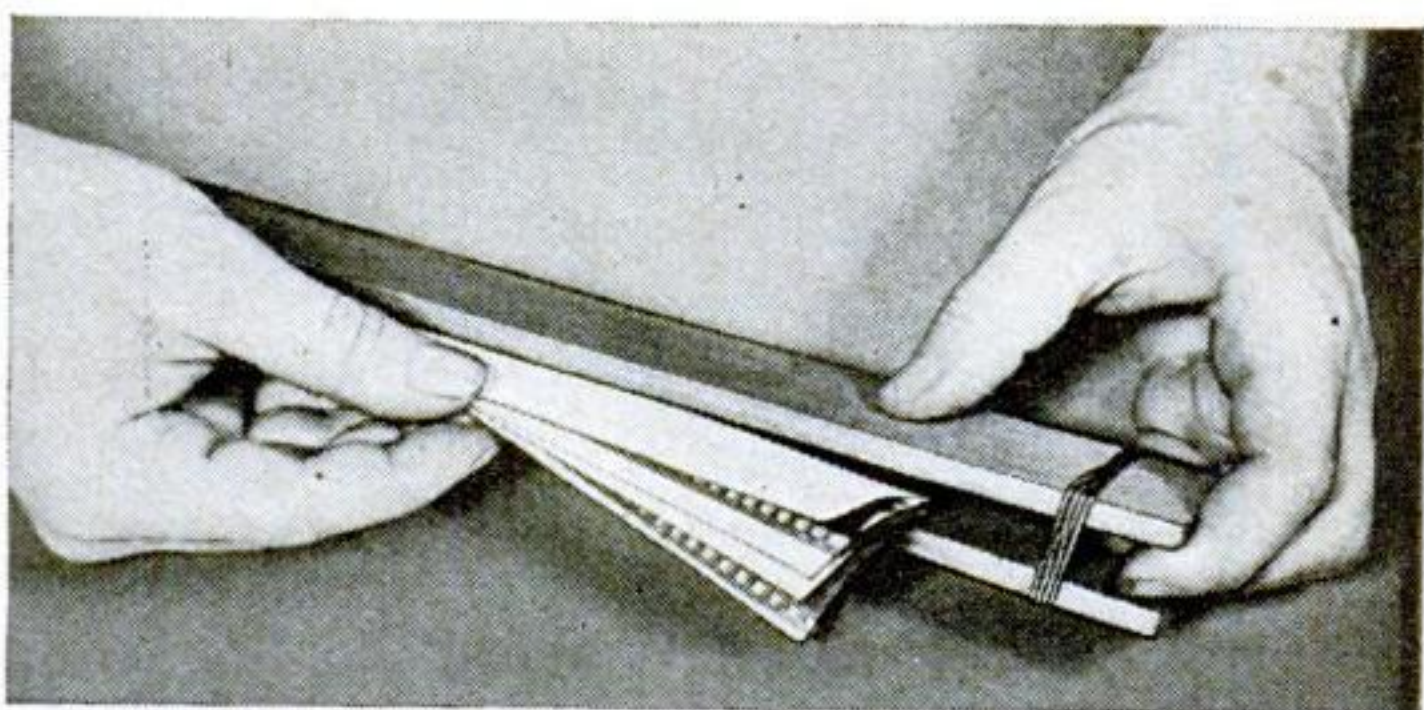
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Bottling Photo Chemicals



IN BOTTLING developing solutions for stock use, it is necessary to exclude as much air as possible, yet it is difficult to cork a well-filled bottle because the air pressure forces the cork out. To overcome this, insert a nail with the cork as shown, and the air will be allowed

to escape, leaving the solution practically airtight. Remove the nail after the cork is well seated.—WILLIAM SWALLOW.

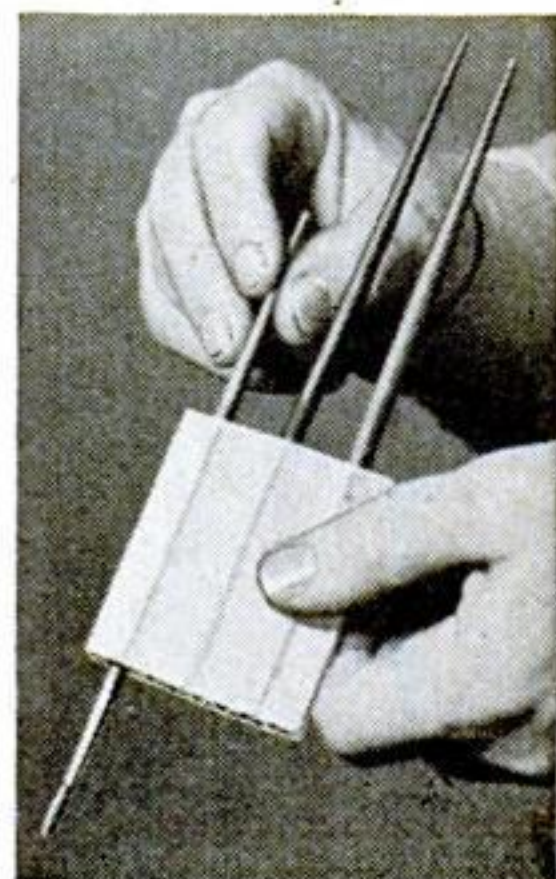


Small Press Removes Curl from Miniature Films

AFTER miniature films are processed and dried, they usually have an objectionable curl that may cause scratches when they are pulled through the enlarger. To press out this curl, make two strips of $\frac{1}{4}$ " thick wood as long and as wide as the strips of film and wrap several rubber bands around the ends. Place the film between pieces of clean white paper and slide them between the wood strips. In from twenty-four to forty-eight hours the curl will usually disappear.—C. ELMER BLACK.

Holder for Retouching Brushes

A SMALL rectangle of corrugated pasteboard makes an excellent holder for photographic retouching brushes or other small water-color brushes. Push each brush, end first, through a corrugation; then pull the end farther until the bristles are safely inside. To remove the brush, pull it out in the same direction.



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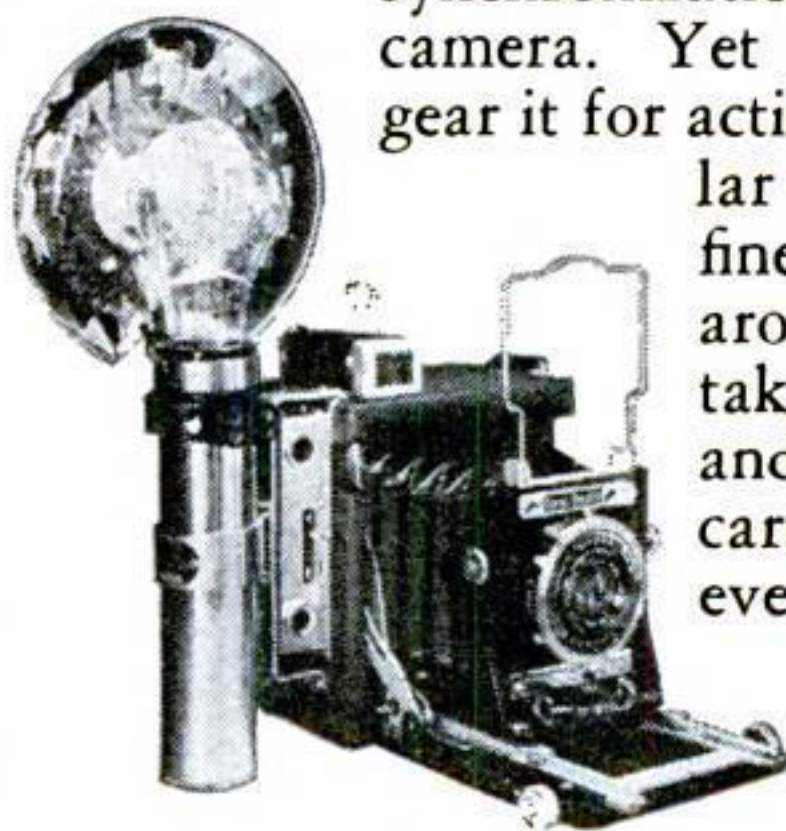
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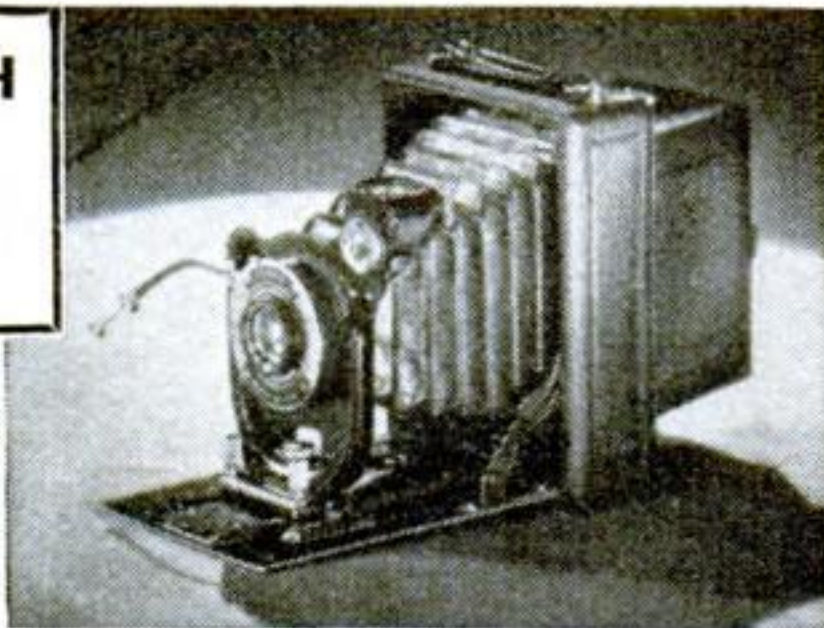
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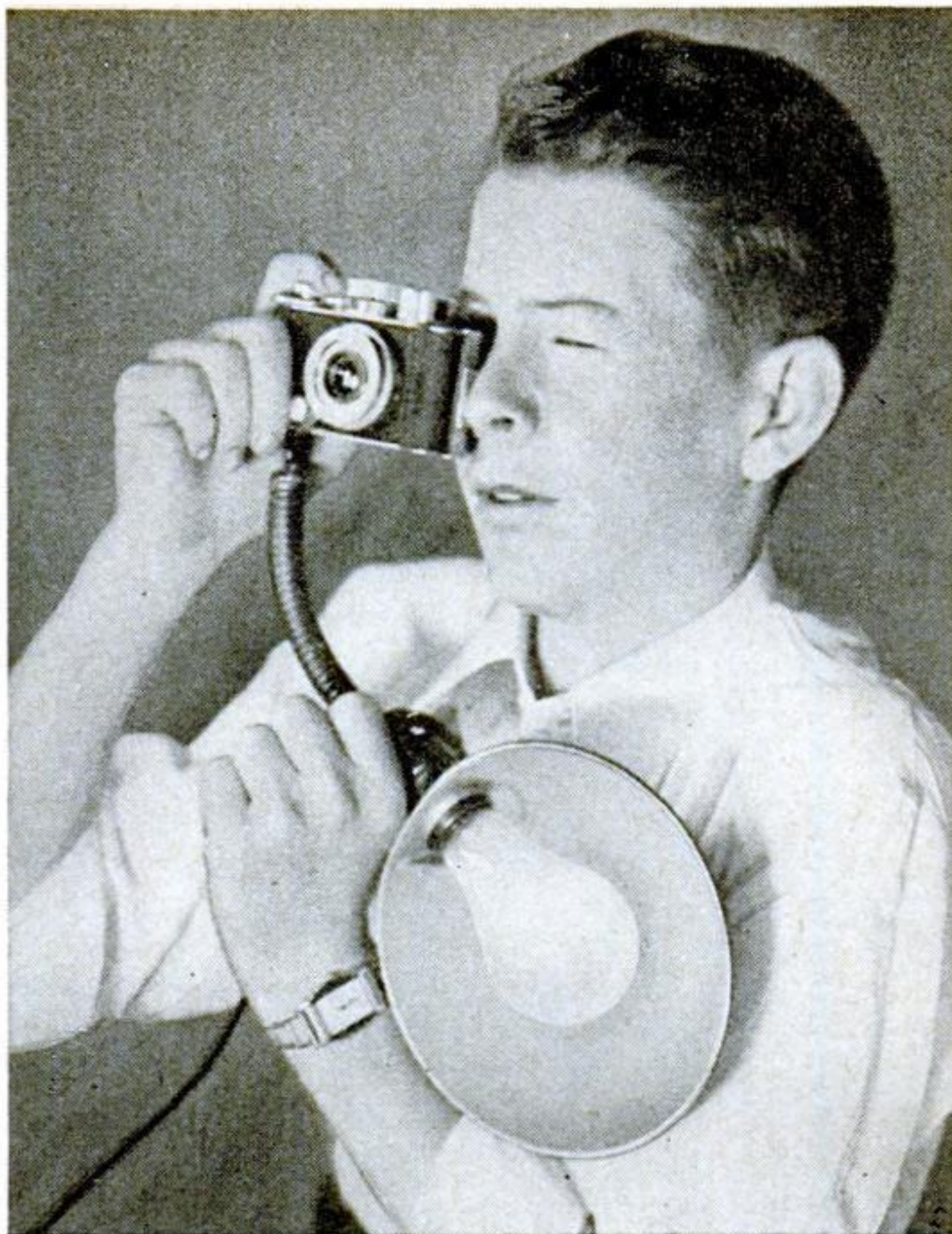
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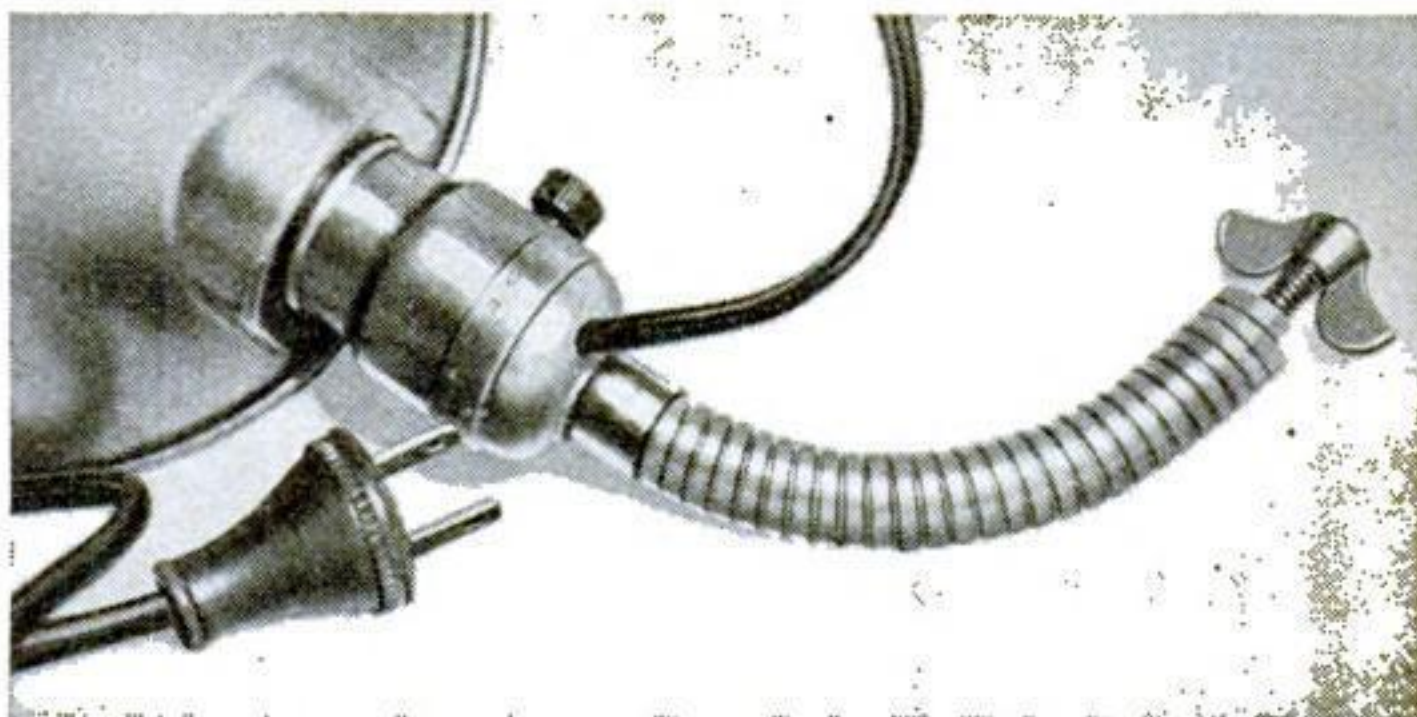
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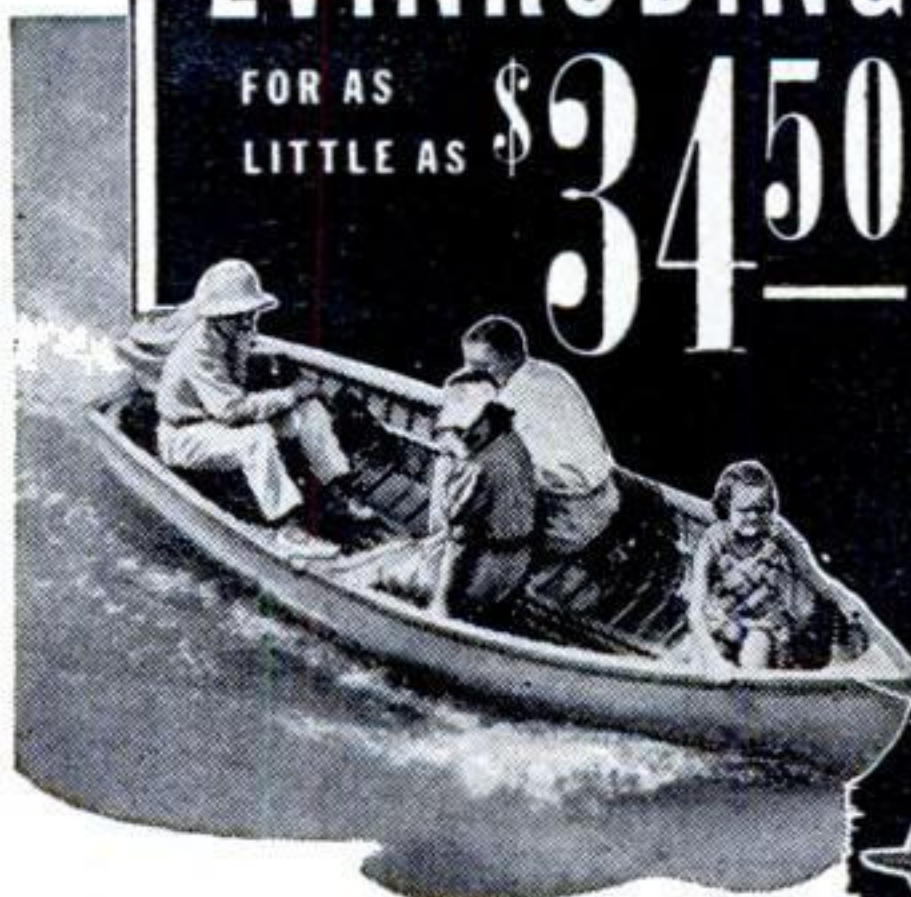
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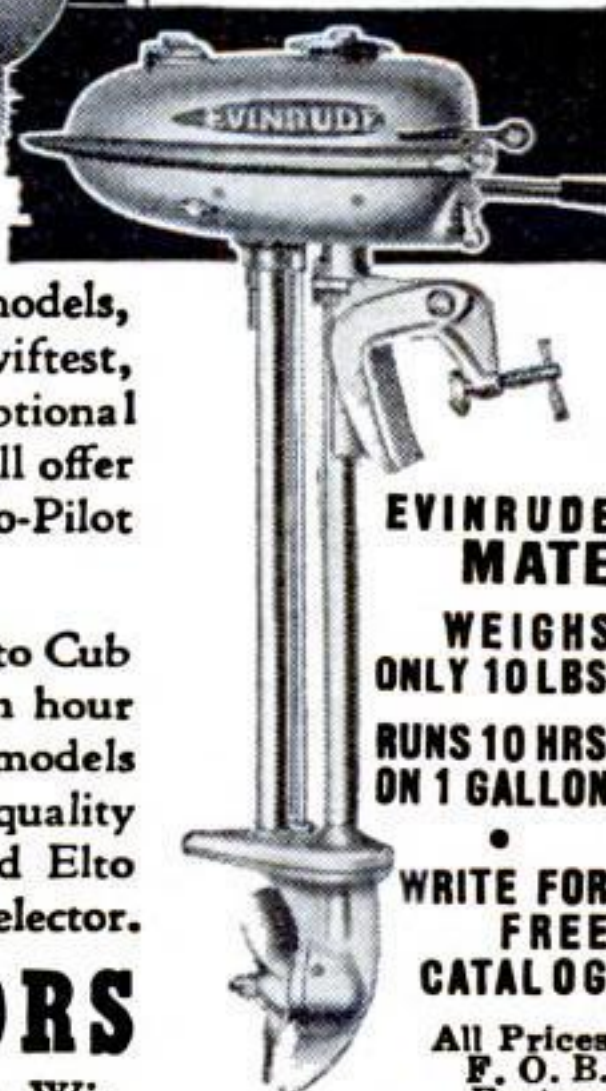
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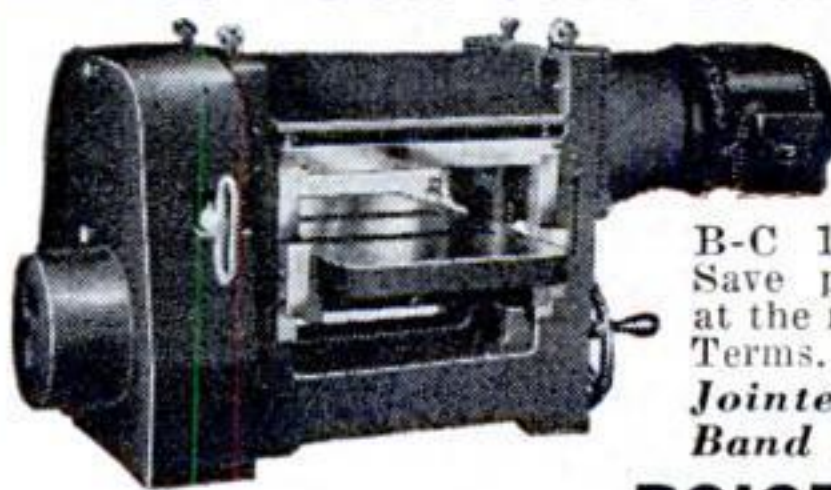
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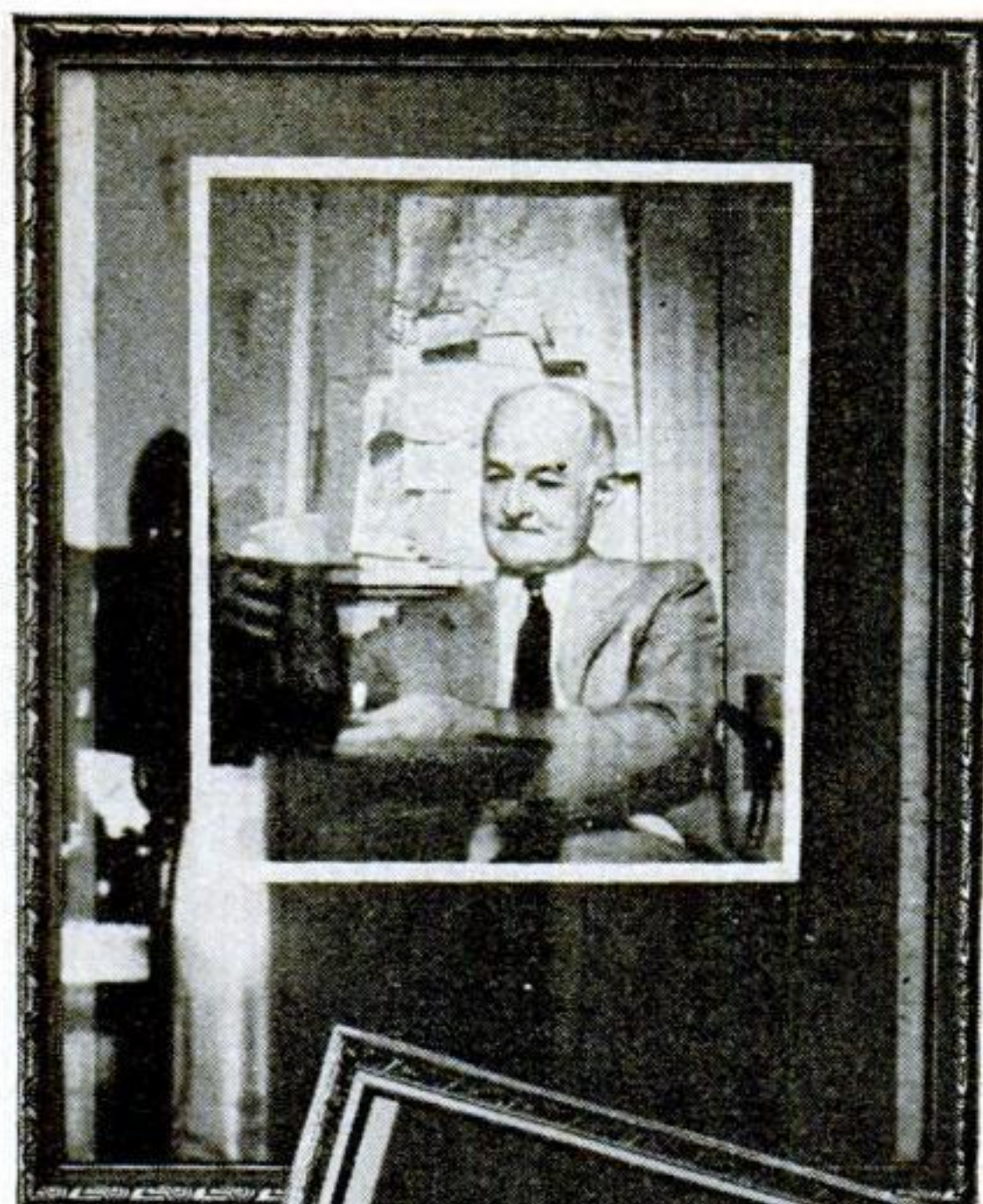
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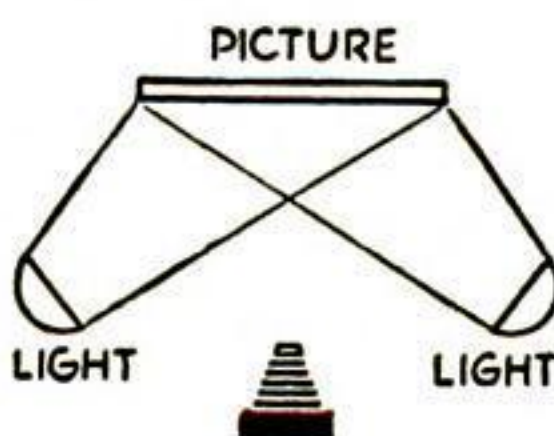
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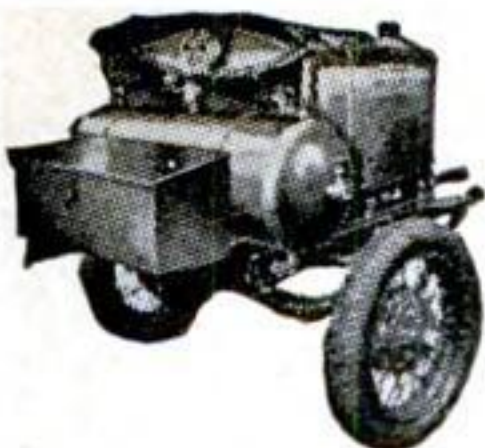
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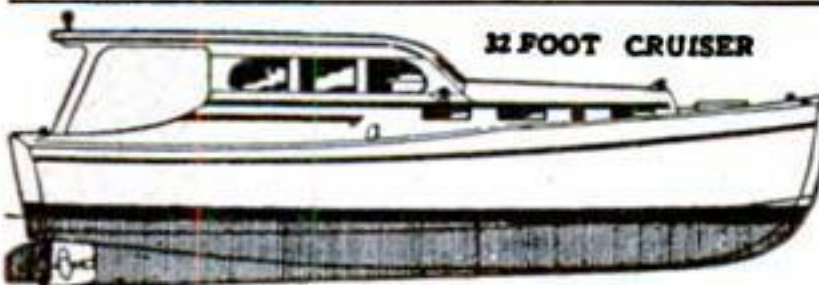
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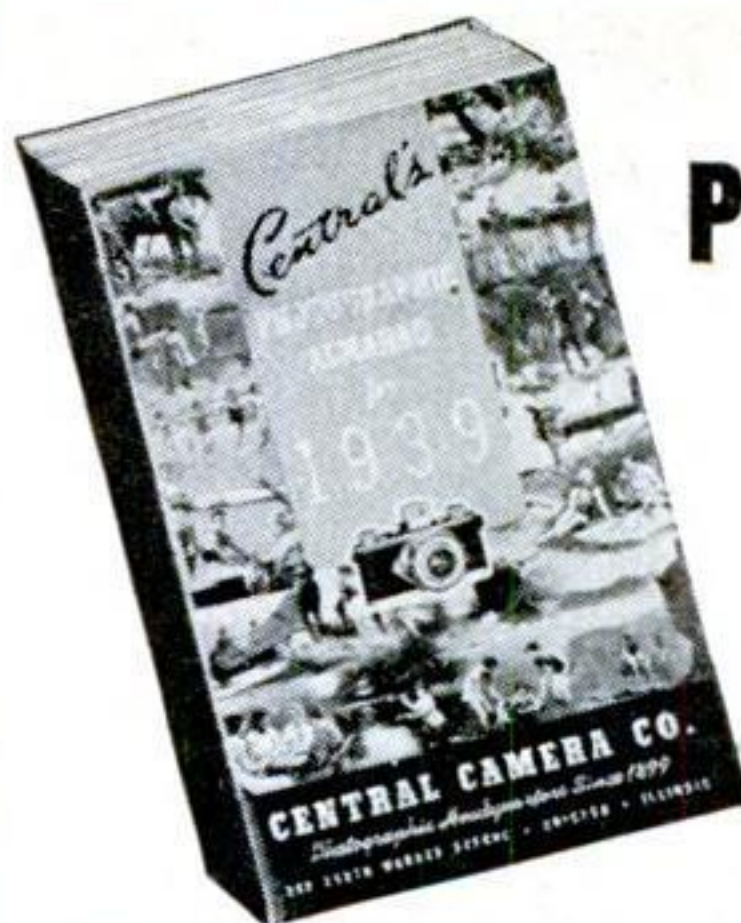
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If you want to make a ring or plug gauge that is a gauge, at least forty-eight hours should elapse between the rough-grind, the finish-grind, and the lapping operations.

I don't criticize the tool-room foreman who insists on a \$500 bench lathe if his requirements involve instrument precision. The fact remains that for regular routine small work, three dependable lathes can be had for that much money.

You can prevent premature natural wear of the guide posts and bushings of die sets by lapping off the initial wear before assembling.

Any plumber, steamfitter, or machinist who has skinned his knuckles to the bone or turned a hand-spring when using a worn pipe wrench, is likely to insist thereafter on tools with removable jaws so they can be resharpened easily.

If a small end mill is to do its stuff economically and stand up, it must have adequate surface speed. Modern electrical and variable-speed attachments make the old vertical fixtures look like antiques.

As a general rule, when no lathe tapering attachment is available, I prefer taking two or more separate longitudinal cuts with the compound rest rather than disturb an accurately set tailstock.

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High-School Sleuths Run Scientific Detective Agency

(Continued from page 113)

come captains and Jarvis lieutenant. Among the quiz questions which a candidate for promotion must answer correctly are these:

“What personal qualities should a detective have that are not essential to a policeman or a layman?”

“Define the following: Slander, libel, arson, jury, defendant, alias, accomplice, mutiny, oath, malice, search warrant.

“Draw a diagram showing how two men can surround a house.

“What class of criminals usually kill by poison?”

“Define abduction.

“What is the motive behind crimes against property?”

Lesson leaflets which embody such information are sent out to all members of the organization. This material covers a wide range of subjects from the most effective method of taking fingerprints to the best manner of preserving perishable bits of evidence.

When a boy or girl—yes, there are three girl members of the agency—becomes an officer, he or she receives a badge and certificate. Dues in the organization are one dollar for the first year and fifty cents annually thereafter. Customers, hiring the services of the agency, do so by written contract and notices are posted on the property announcing that it is being protected and inspected by the Tri-State Detective Agency. Rewards are offered by the agency for information leading to the arrest and conviction of anyone damaging property under the protection of the organization. So far, however, it has never been necessary to pay out a reward. The posters and the vigilance of the boy detectives have kept away all intruders.

The members of the organization justly resent being called “kids playing cops and robbers.” They point to ledger books as evidence to the contrary. Recorded on the pages of these books in businesslike fashion are the fees which have been paid to the agency for services rendered. Most of this work, at present, consists of guarding private property from the depredations of marauders.

Recently, so many inquiries have come in that young Bassette and his fellow sleuths have been swamped. The idea which started nearly three years ago, when Halloween pranksters painted a New England stone wall, is spreading rapidly. Out of the beginnings at West Hartford, it seems likely, an important new youth organization, which will offer training in citizenship and law observance, may spread to all parts of the country.



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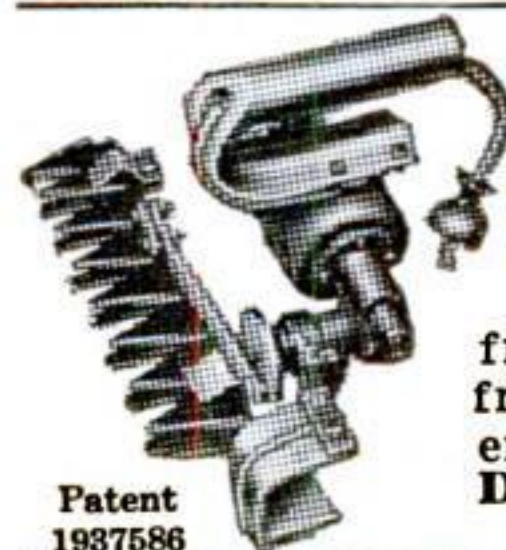
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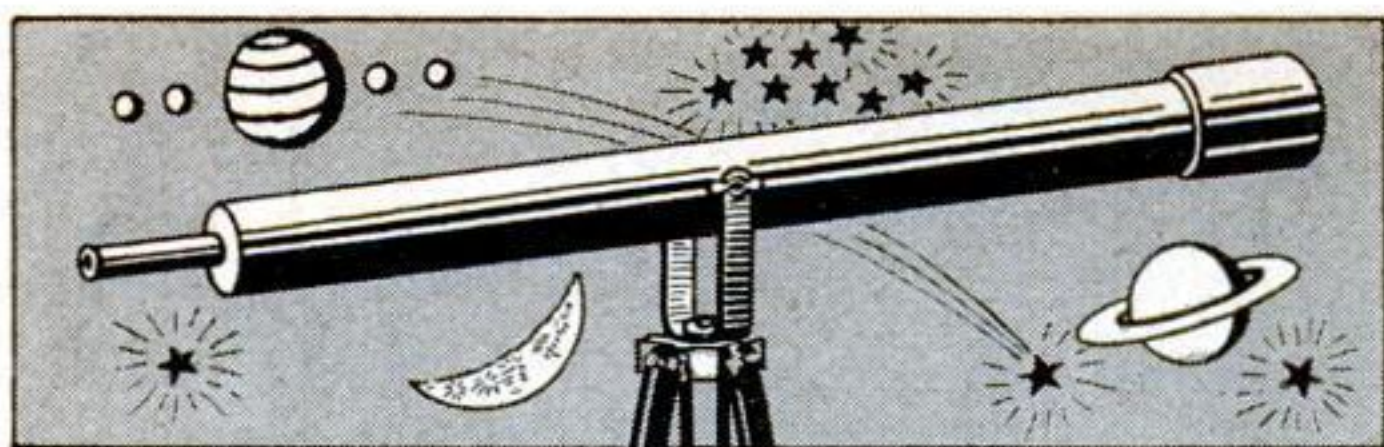
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Gus Looks for Trouble

(Continued from page 132)

your car up now, and told you about the trouble some other time."

He jumped out of the car, and hurried into the shop. In a moment, he came out with a six-inch strip of tire tape in his hand. Reaching under the cowl, he wrapped the tape expertly around the worn spot in the dash wire's insulation.

"Now, you won't have any more trouble," he assured Mrs. Miller. "I don't want to hurry you, but it's almost five o'clock, and the traffic—Good-bye, Mrs. Miller!"

He watched her drive away, and turned back toward the shop to see Joe Clark grinning at him from the office door. "Have a nice visit with Mrs. Miller?" Joe wanted to know. "Say—what was the matter with her car, anyhow?"

Gus told him.

Joe scratched his head doubtfully. "I guess maybe I'm as dumb as Mrs. Miller," he said. "But I'll have to admit that I don't see what made the cable move over toward the dash wire, or why . . ."

"Huh?" Gus said. "Oh! Well, you know that a speedometer cable has a rotating core, don't you? And that the faster a car travels, the faster the core rotates? What happened in this case was that the core rotating in that bend in the cable caused a torque which pulled the cable over toward the spot where the insulation had worn off the dash wire. When the speed got up to twenty-five miles an hour, the torque was sufficient to pull the cable over against the bare spot in the insulation to cause a short in the wire leading to the engine switch. That short, of course, killed the engine. As soon as the torque decreased, the cable moved back and the engine fired again. Simple enough!"

"Sure," Joe said. "Simple enough—once you've found it."

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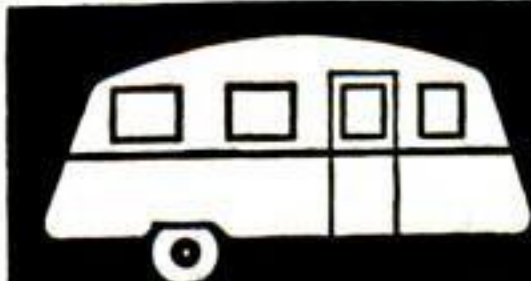
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Fun with Black Light for Home Chemists

(Continued from page 191)

Now smear a bit of this preparation on a plate of glass, just as you would apply such a cream to the skin. Hold the coated plate between an argon lamp and some fluorescing substance. The fluorescence will stop, showing that the ultra-violet rays have been absorbed.

A much better "sun-tan" cream for practical use can also be made easily in your home laboratory. Melt twelve and a half grams (two and a half teaspoonfuls) of lanolin and thirty-seven and a half grams (seven and a half teaspoonfuls) of petroleum jelly in an evaporating dish. Add 100 cubic centimeters or about three and a half fluid ounces of rose water, a little at a time, stirring meanwhile. Then stir in fifteen grams (about three teaspoonfuls) of calamine powder, which is a zinc compound. A drug store can supply you with these ingredients.

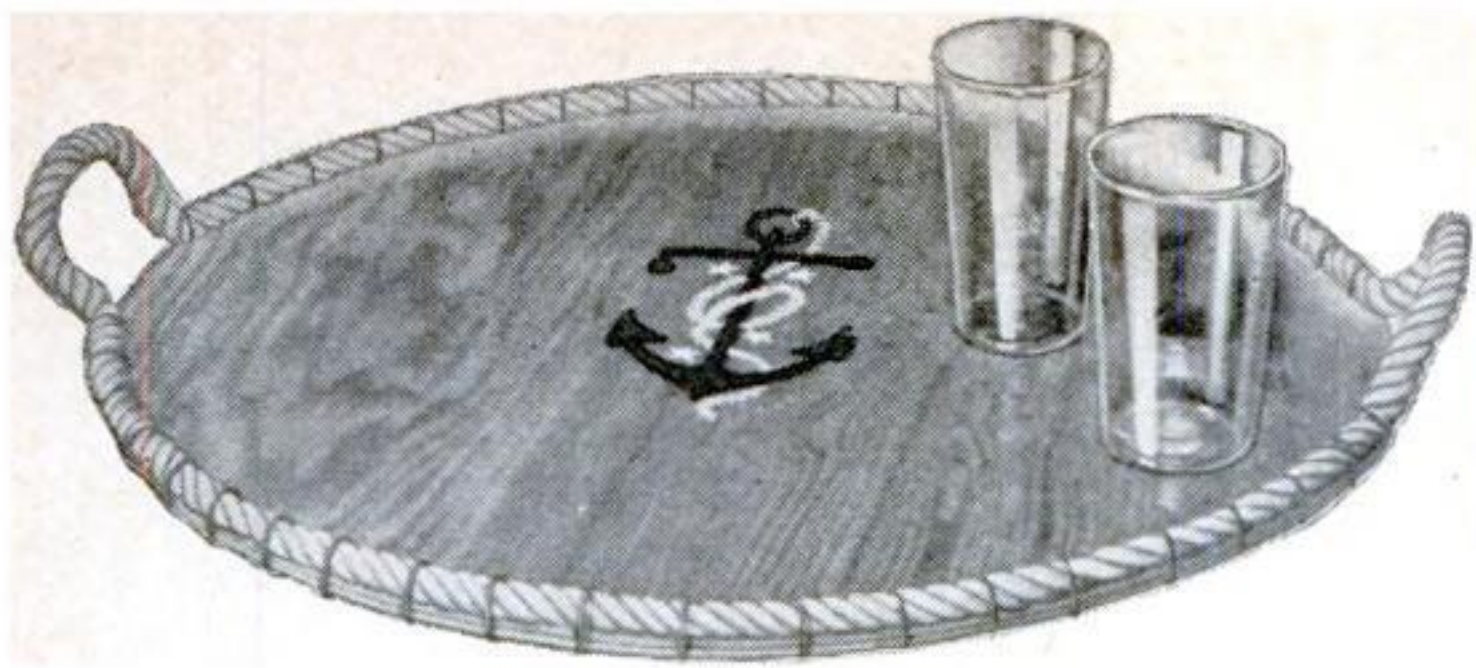
Dentist Extracts Teeth Then Puts Them Back

INFECTED teeth can now be removed, repaired, and put back into a patient's jaw by a novel method used by a Michigan dentist. An abscessed tooth first is X-rayed, then extracted. Any abscess in the jaw is treated. The tooth then undergoes a series of repairs and is partially resurfaced. Sterilized, it is set back into the cavity in the jaw and held in place with a gold splint, which is worn for about a month to give the gum and tissue time to grow back around the tooth. It is claimed the repaired teeth last five to ten years after being replaced in the mouth.

POPULAR SCIENCE Question Bee

To FIND your score in the Question Bee on page 126, compare your results with the list below. The letter alongside each number indicates the correct answer to the corresponding question. Give yourself five points for each one you had right. A total of 75 to 85 points is good; 90 or better is excellent.

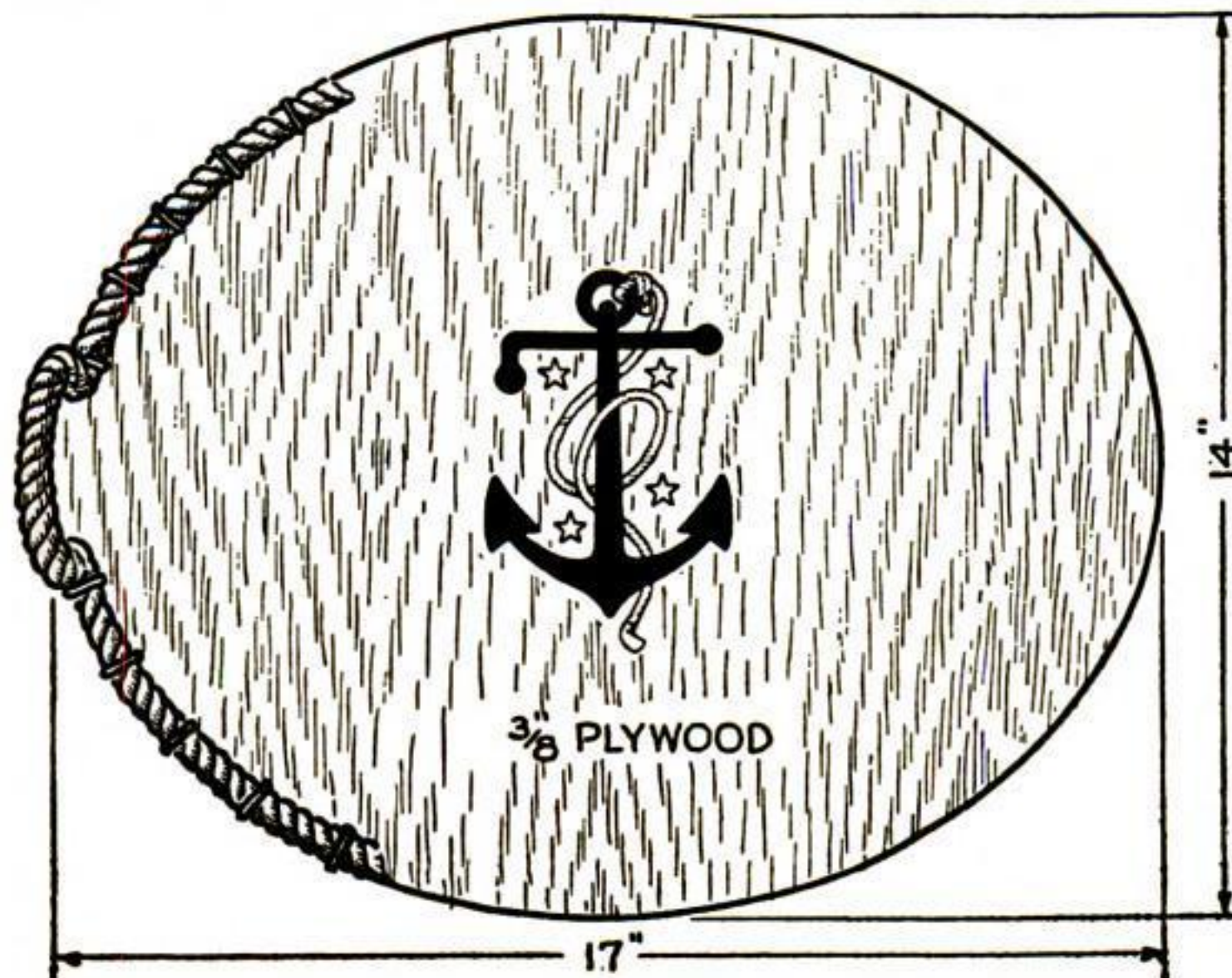
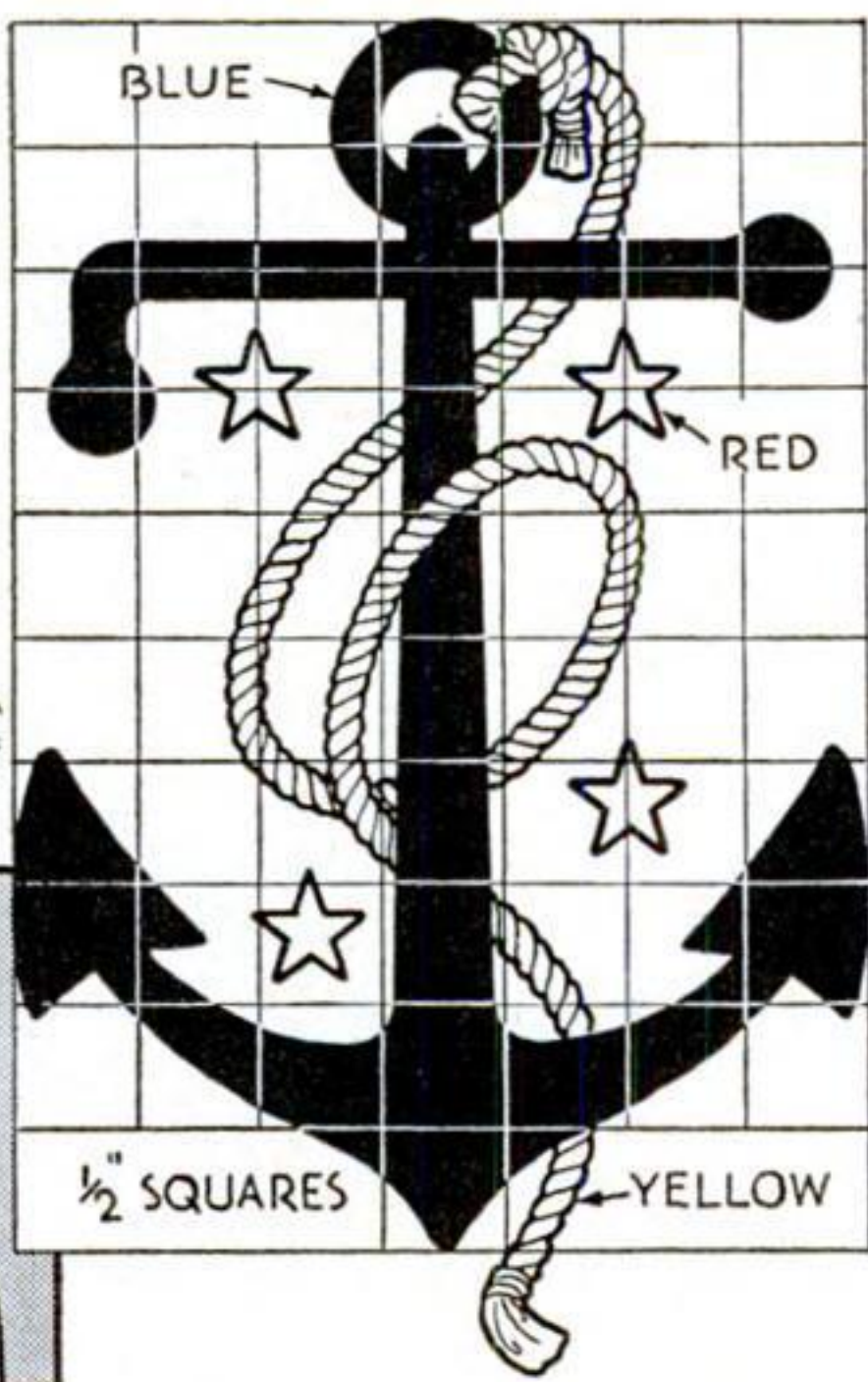
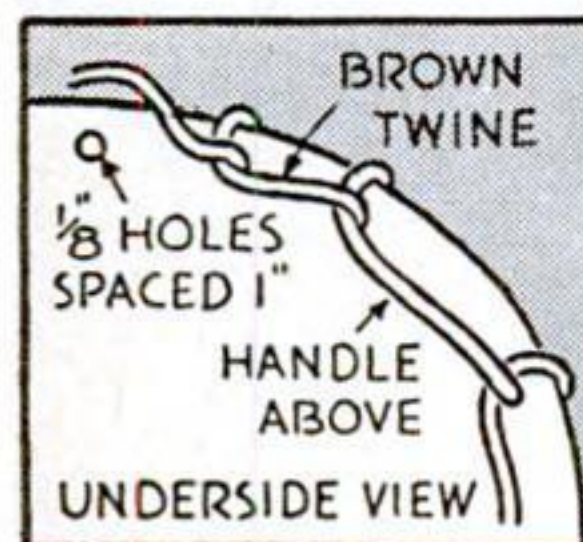
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|------|------|-------|-------|-------|
| 1. b | 5. d | 9. d | 13. a | 17. b |
| 2. c | 6. b | 10. c | 14. c | 18. c |
| 3. a | 7. b | 11. b | 15. a | 19. b |
| 4. d | 8. b | 12. b | 16. c | 20. b |



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Method of making the tray and the design used. This may be a transfer



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Looking at Shells with Your Microscope

(Continued from page 197)

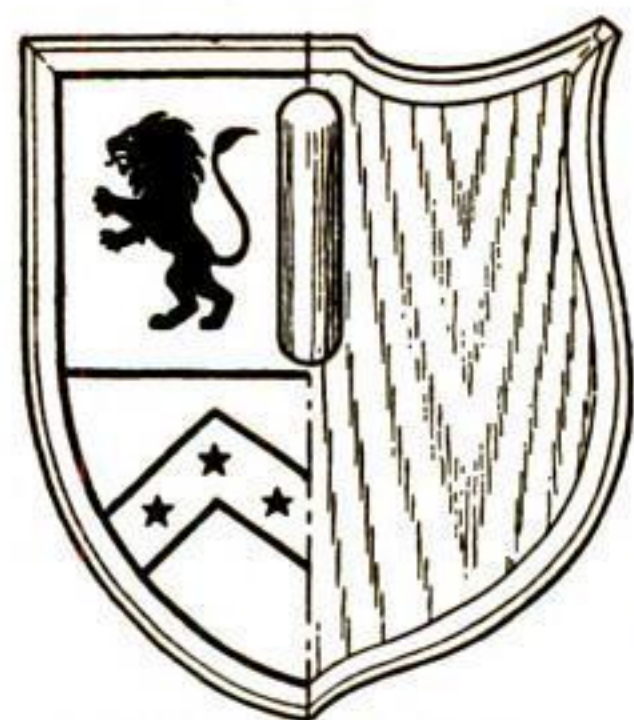
membranes. These reflect light in such a way that an iridescent effect is produced. The thinner the membrane, the better the iridescence, which is said to be the reason why salt-water pearls, which are composed of thin membranes, are superior to fresh-water pearls, whose membranes are thicker. The membranes are permeated with lime, which acts as a cement to hold them together. The acid treatment described removes this lime, so you can separate the membranes. You will find that they still possess the characteristic iridescence after removal from their natural position. Stretch them with the aid of dissecting needles or tweezers, and you will see that the iridescence disappears.

It sometimes is difficult to determine, by examining the surface of a shell or other object with a monocular microscope (with a stereoscopic binocular instrument it's easy), whether that surface is absolutely smooth, marked with ridges, or otherwise figured. There is a simple way that you can do this, when the material being examined is sufficiently rigid. Obtain some flexible collodion from a drug store, and with a toothpick transfer a drop of it to the surface, letting it spread out into a thin layer. In a few minutes, the solvent alcohol and ether will have evaporated, leaving a film of pyroxylin or guncotton on the surface. With a knife or tweezers raise one edge of the film and strip it off. Place it on a glass slide and examine it with your microscope. If the surface was marked by irregularities of any kind, the collodion film will show them. Try taking such collodion casts of the mother-of-pearl layer and the outer surface of a shell. To examine collodion films, use transmitted light and a small substage-condenser opening. Dark-field illumination sometimes is an advantage. Staining the film by mixing a dye in the collodion solution will increase visibility.

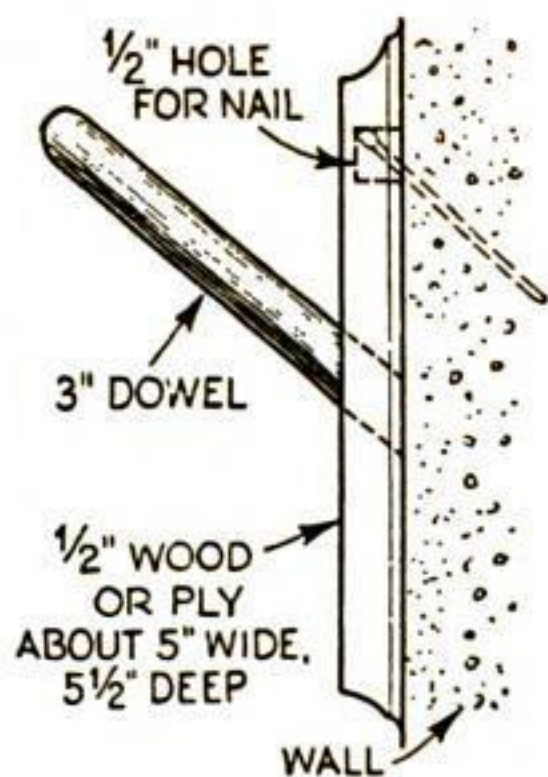
Here is a bit of research that you can do in your study of shells: Make a cross section of an oyster or other shell, and examine it with your microscope to see exactly how the prisms look when sliced lengthwise, and how the mother-of-pearl layers are arranged.

You think that's too difficult, slicing a piece of hard and brittle shell? It's fairly easy. You use the same technique employed for making sections of coal, bone, and other hard materials. Briefly, the process, which has been described in detail in an earlier article of this series (P.S.M. March '38, p. 96), is as follows: Break a shell in two and

(Continued on page 236)



ALTERNATIVE DESIGNS



Neat Way to Hang Objects on a Plastered Wall

HEAVY objects may be hung on a wall without noticeably marring the plaster by the method illustrated. A sixpenny finishing nail is sharpened to a needle point and driven into the wall at about a 45-deg. angle. On this is hung a plaque made as shown. This will hold a surprising weight; in fact, two such plaques 4" by 6" easily hold a Civil War musket.

For lighter objects such as T-squares and triangles, it is sufficient to drive in a nail as described and cover the projecting part with a dowel through which a hole has been drilled, or anything that will form a suitable peg.—JACK HAZZARD.

Wooden Hooks Support Attic Clothesline

WOODEN hooks made from scrap plywood pieces about 3" by 9" as shown are convenient for supporting a clothesline in an attic or a basement. Fasten the line at each end and screw a hook about every third joist. It is best to stagger the slots when placing the hooks. The line is unhooked while clothes are pinned on.—M. S. DEMY.



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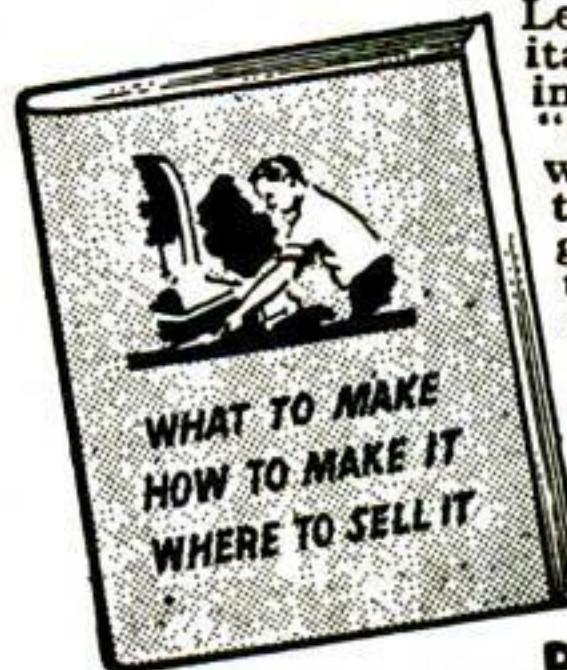
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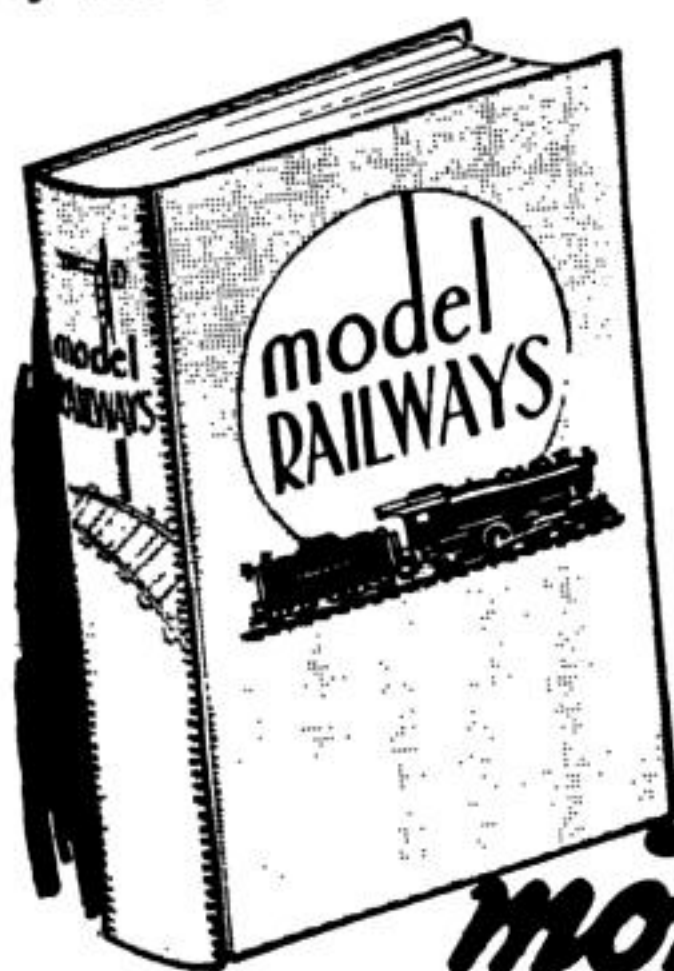
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Looking at Shells with Your Microscope

(Continued from page 234)

with a file or rough stone make one of the edges flat. Then, with a fairly fine abrasive stone kept wet with water, grind this edge smooth. Finish by polishing on a very fine razor hone, also wet with water. With a hack saw, or by some other means, cut a piece from the shell, near the smoothed edge. Mount this piece, flat edge next to the glass, in the center of a 1" by 3" microscope slide, with hot balsam. When the balsam is cool, and the piece sticking firmly, grind and polish as before to a thickness of a few thousandths of an inch.

Usually the section will be clean enough after washing to examine without removing it from the glass slide. For a permanent mount, simply cover with balsam and a cover glass. By this method, you can grind and polish other shell sections to show the prisms in cross section, the nacre layer, and so on. Often it is necessary to grind and polish only one surface of a thin shell.

Thus you have found that a typical mollusk shell, such as that of the oyster or mussel, consists essentially of three parts: The outer protective layer of animal membrane, called the periostracum; the intermediate and strength-giving prismatic layer made up of limestone blocks incased in membrane; and the inner layer of nacre, or mother-of-pearl.

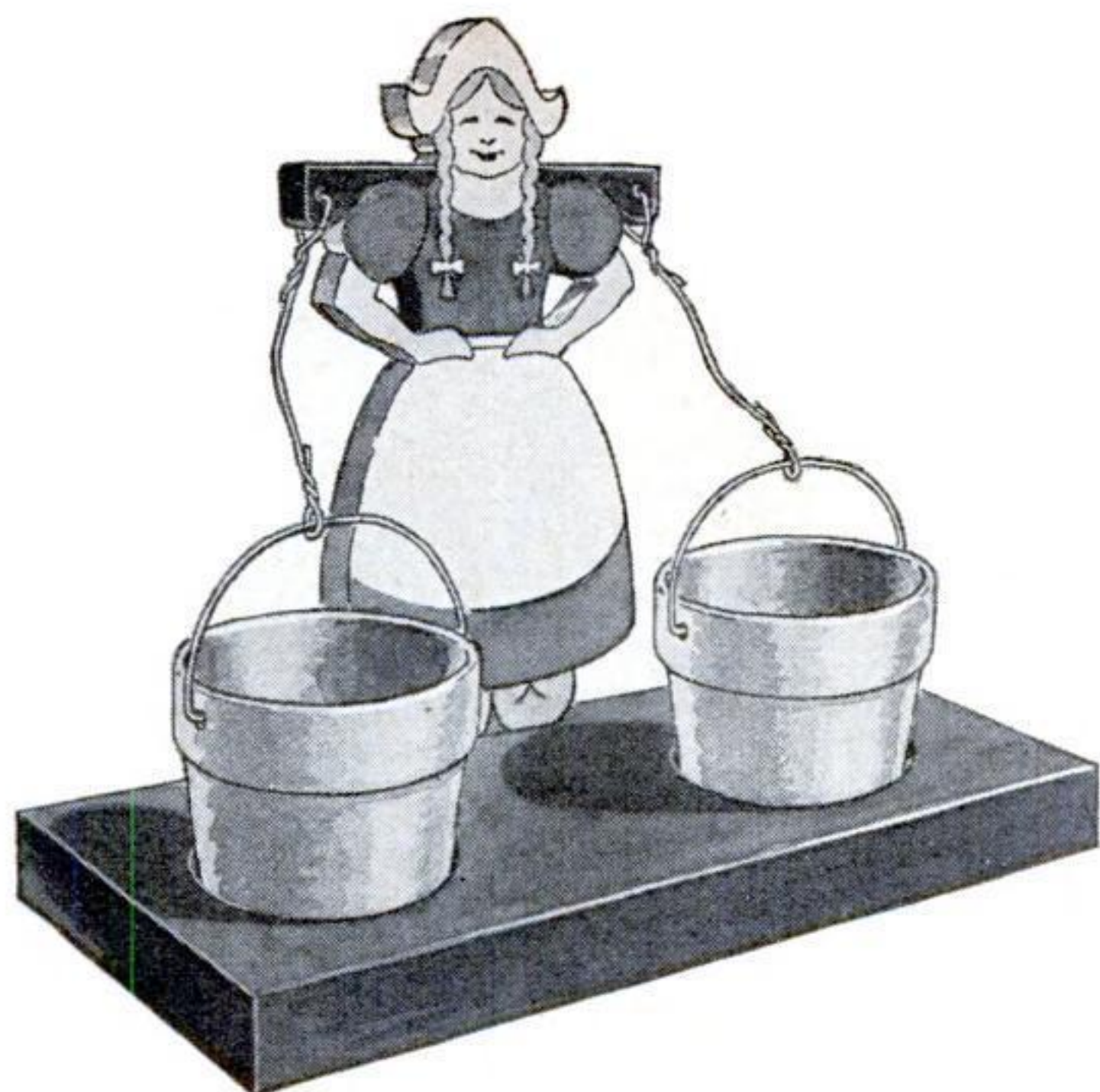
This study of a shell may lead you into a more thorough investigation of the microscopic wonders to be found in the sea. One of them is the cuttlefish bones you can buy for a few cents in a bird store or at the "five-and-ten." They are not really bones but are the boat-shaped shells of the cuttlefish, and consist of limestone. They are carried inside the fish, like a stiffening rib or beam. Cut a cross section from a cuttlefish shell (which is easy because the material is soft enough to be worked with a knife), and examine it with your microscope. You find a series of layers, like the floors of a building, separated by numerous parallel "columns." Now make a longitudinal section by slicing parallel to one of the layers, and you discover that the "columns" really are ribbons of material that wind about in erratic fashion, acting like strips of bent or corrugated iron to support the successive layers.

From the sea you can obtain sponges that show various structures in their silica skeletons; diatoms, protozoans, and plants and animals in endless variety, for microscopic study. Any of these might provide material for days of observation without becoming tiresome.

This One

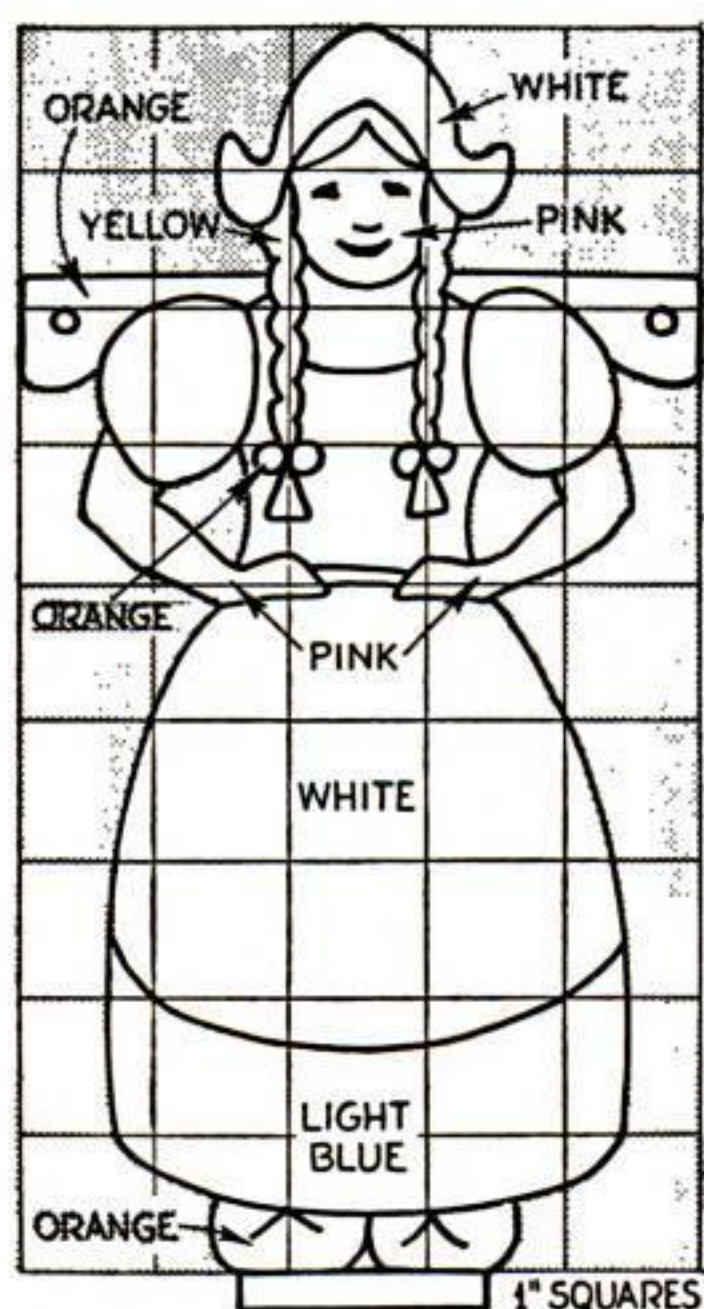


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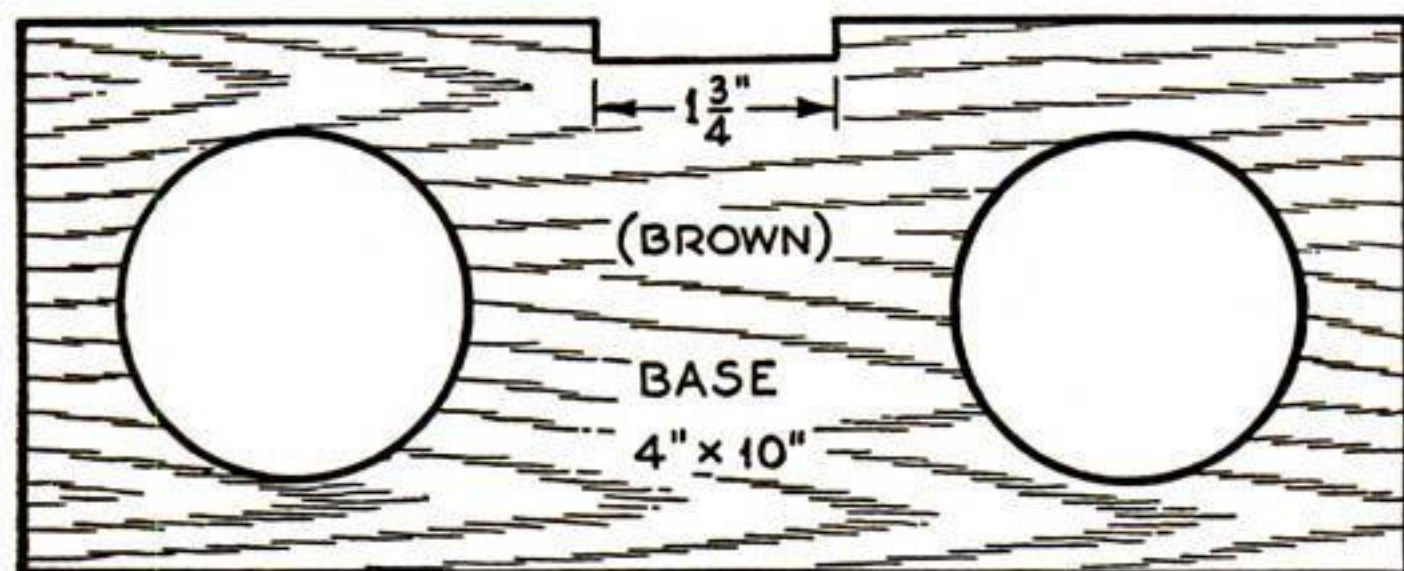


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Pattern drawn on squares to facilitate enlargement



The base is made of two thicknesses. A notch and two holes are cut in the toppiece before assembly

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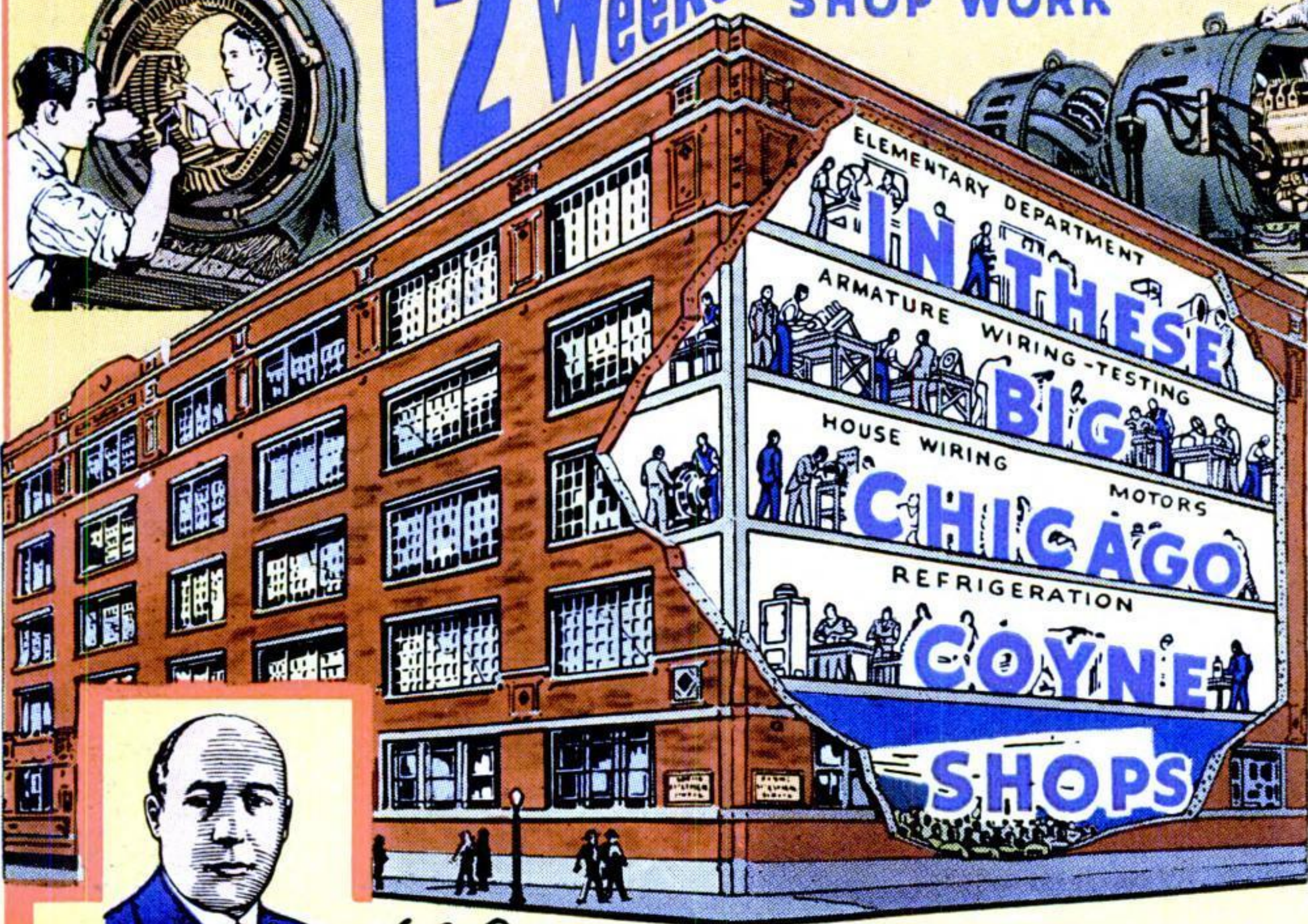
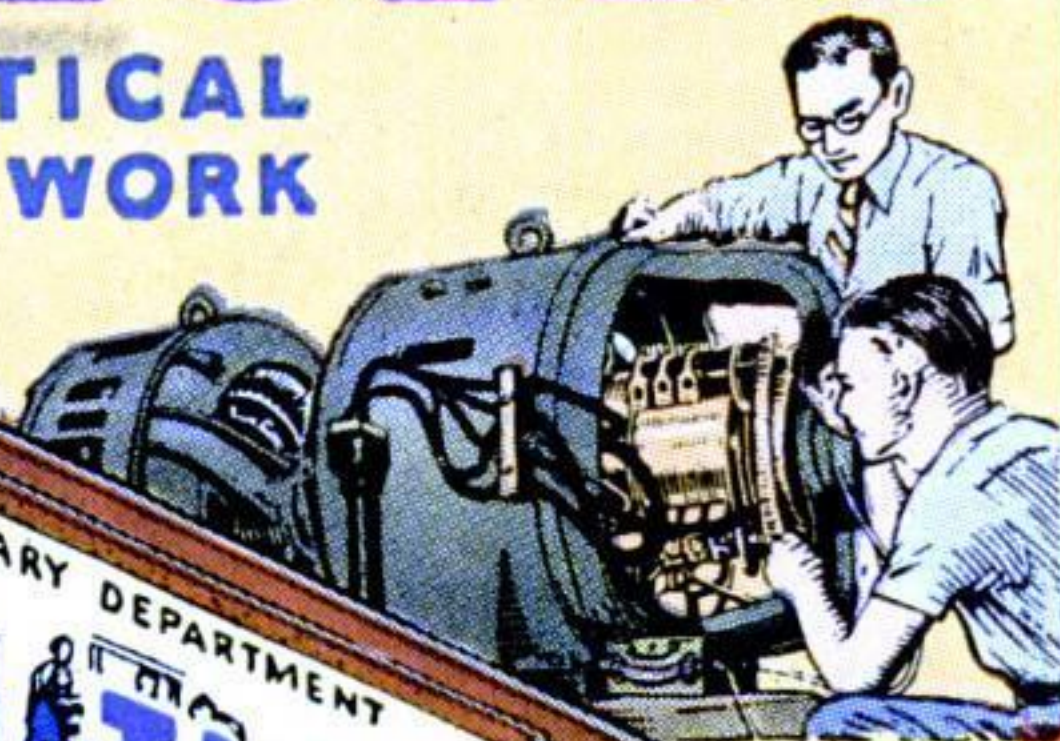
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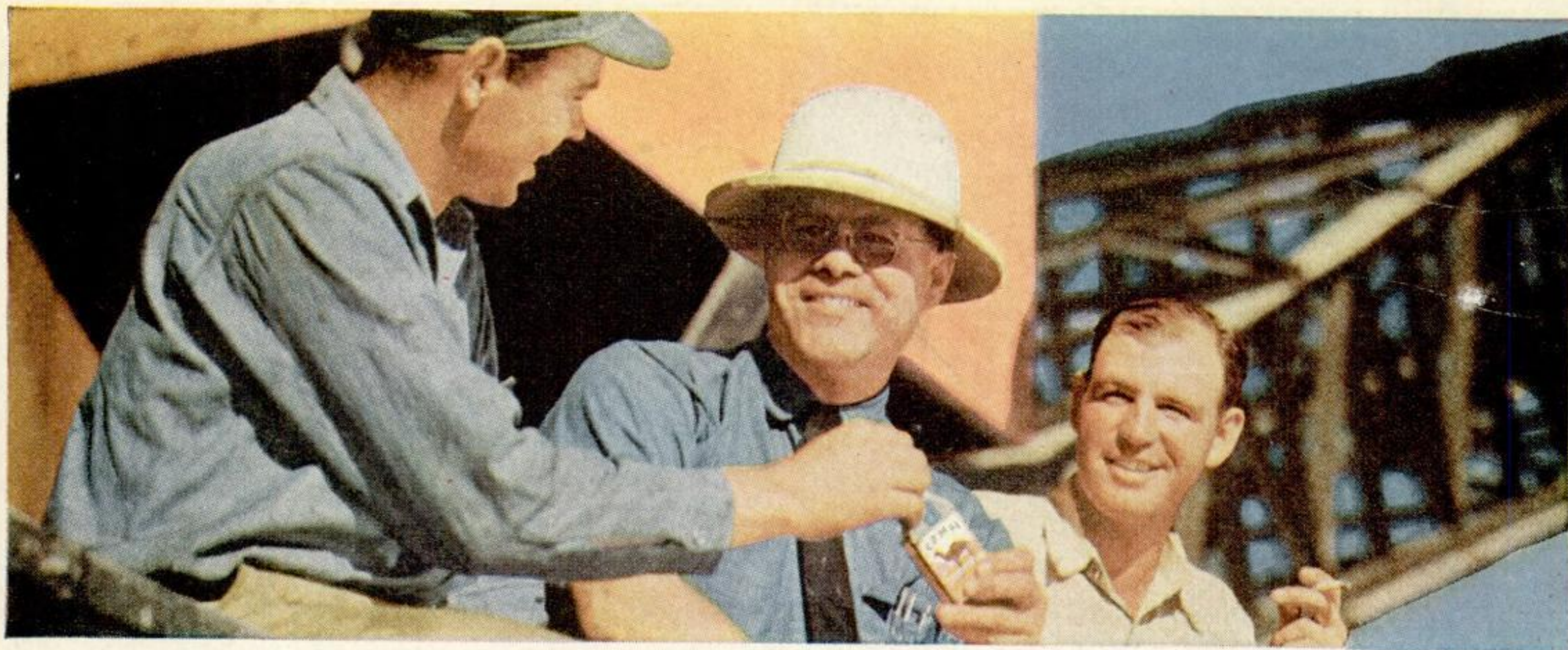
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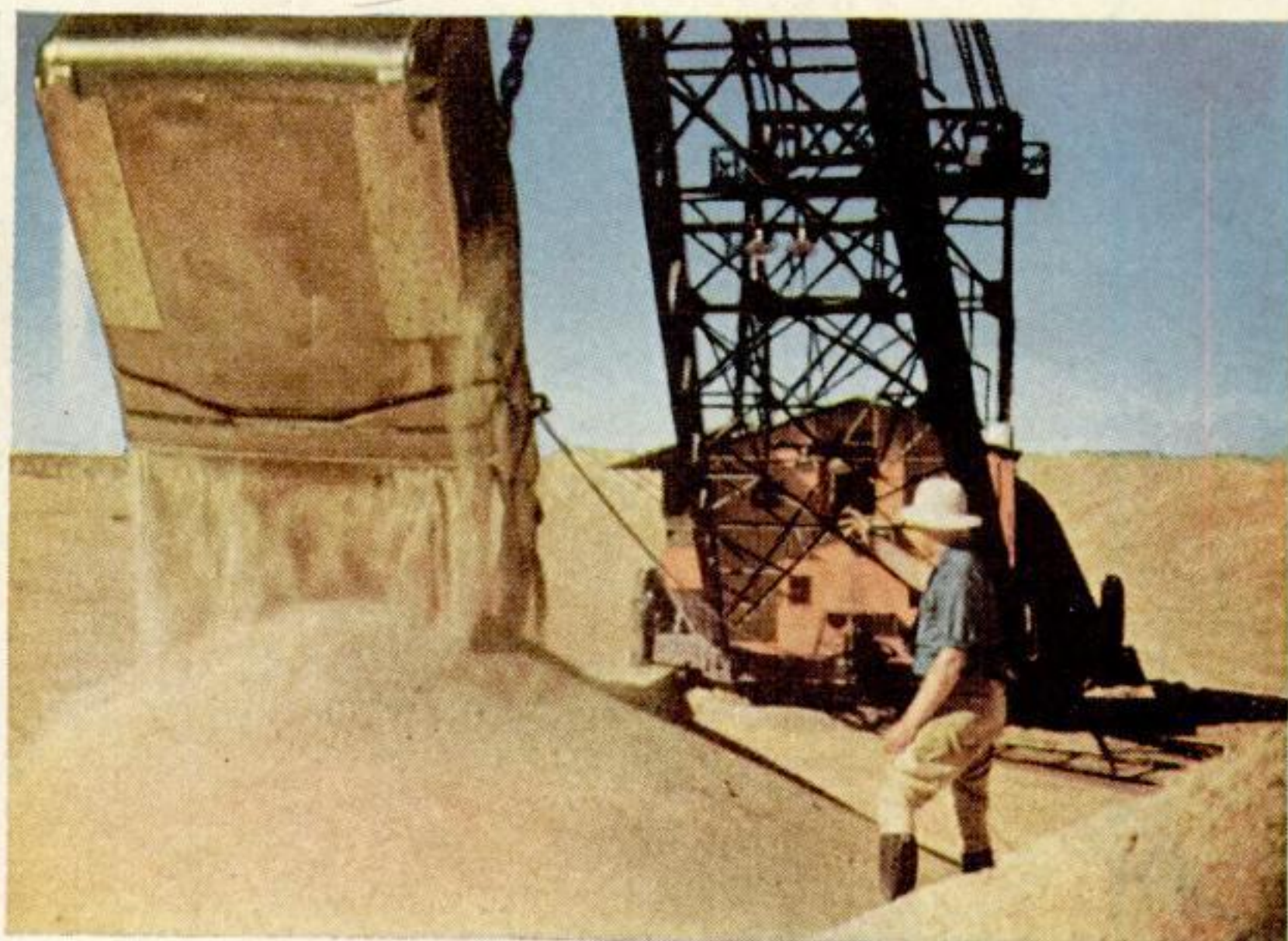
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